

MORTON
ON
CALCULOUS CONCRETIONS
IN THE
HORSE, OX, SHEEP, AND DOG.



Hugh Cecil Earl of Lonsdale.

1844.

223 On Calculous Concretions in the Horse, Ox, Sheep, and Dog, being the substance of two essays read before the Veterinary Medical Association, by **W. J. T. Morton**, Lecturer on Medical Chemistry and Veterinary Materia Medica, Author of a Manual of Pharmacy for the Student of Veterinary Medicine, and a Veterinary Toxicological Chart. London. 1844.

8vo. 94 pp. 4 coloured engraved plates and woodcuts.
M., 9 in. by 5½ in.

Dedicated to Charles Spooner, Esq., Professor of Anatomy and Physiology at the Royal Veterinary College, President of the Veterinary Medical Association, etc.



THIS BOOK RESTORED IN 2019
THROUGH THE SUPPORT OF

LORIAN PERALTA-RAMOS

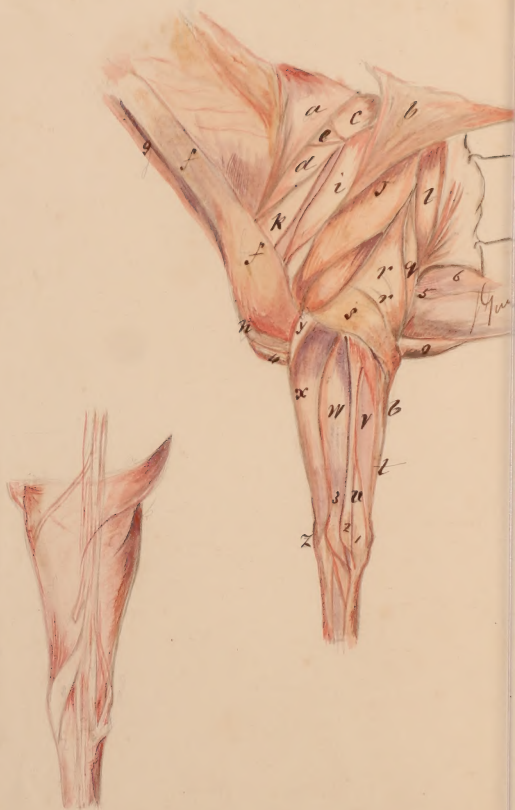
ON CALCULOUS CONCRETIONS

IN THE

HORSE, OX, SHEEP, & DOG.

PRINTED BY COMPTON AND RITCHIE, MIDDLE STREET, CLOTH FAIR.





{a Portion of Trapezius Muscle

c portion of levator humeri

d portion of serratus magnus

e portion of splenius

f portion of levator humeri

g portion of Sternus maxillaris

h principal portion of do -

i antea spinatus

j postea spinatus

k pectoralis parvus

l

m

n

o

q Extensor longus

{r Muscles of the humerus

t & b Flexor medius metacarpi

u Extensor Supraglenius

v Flexor metacarpi externus

w Extensor pedis

x Extensor metacarpi

y Humeralis Externus

z Extensor metacarpi obliquus

1 Flexor pedis perforatus





Mortou ou Calentius, c. 10. 1810.

3/6

CALCULOUS CONCRETIONS

IN THE

HORSE, OX, SHEEP, AND DOG,

BEING

THE SUBSTANCE OF TWO ESSAYS

READ BEFORE THE

VETERINARY MEDICAL ASSOCIATION,

BY

W. J. T. MORTON,

LECTURER ON MEDICAL CHEMISTRY AND VETERINARY MATERIA MEDICA,
AUTHOR OF A MANUAL OF PHARMACY FOR THE STUDENT OF
VETERINARY MEDICINE, AND A VETERINARY
TOXICOLOGICAL CHART.

ILLUSTRATED BY COLOURED ENGRAVINGS.

LONDON:

LONGMAN, BROWN, GREEN, & LONGMANS,

PATERNOSTER ROW.

—
1844.

TO

CHARLES SPOONER, ESQ.

PROFESSOR OF ANATOMY AND PHYSIOLOGY AT THE
ROYAL VETERINARY COLLEGE, PRESIDENT OF THE
VETERINARY MEDICAL ASSOCIATION, &c. &c.

MY DEAR SIR,

IMPRESSED with the same conviction, and influenced by similar motives, we acted together at the formation of the Veterinary Medical Association; and it cannot but have been alike gratifying to each of us to know that an Institution which we anticipated would contribute much to the advancement of the best interests of veterinary science has more than realized our most sanguine expectations.

I believe I have not been an indifferent observer of the gradual progress it has made; nor am I ignorant of the fact, that much of this has been the result of the lively interest you have always taken in promoting the objects of the Association. At our hebdomadal meetings the lucid and graphic expositions of disease offered by you have tended very considerably to enhance the value of the Papers read. Bearing the impress of truth, they carried

conviction to the mind, and rendered clear and comprehensible that which before was obscure or difficult to be understood; while many of the morbid specimens placed before the Members would have been comparatively of little worth had they not received elucidation from the descriptions given by you of the changes that had taken place, your intimate acquaintance with the anatomical structure of the parts enabling you to explain the entanglement which existed in some of the links of the organism.

Convinced of the verity of these statements, I have ventured to dedicate the following pages to you. When the Essays were read from whence they are extracted, and of which they constitute the substance, you were pleased to express your approval of them; nevertheless, I could have wished they had been more worthy of your commendation. Well do I know that others may present you with more elaborate and more erudite productions of their pen; but they will not exceed in sincerity,

Your's faithfully, and in friendship,

W. J. T. MORTON.

TABLE OF CONTENTS.

PART I.

	Page
Introduction. Laws governing the formation of calculi. Divisions of calculous concretions. Stomachical and intestinal calculi . . .	1 to 17

PART II.

Urinary calculi. Composition of the urine of the horse and other animals, with the principles found therein, and the transmutations they undergo. Causes of urinary calculi. Varieties of. Renal calculi. Uretal calculi. Cystic calculi. Urethral calculi. Cases of the above. Means of removal. Lithotomy. Lithotritry. Lithectomy. Solution	17 to 65
--	----------

PART III.

Occasional calculi. Phlebolites in the jugular vein. Calculi from the thoracic duct. Calculi from the clitoris of an ass. Biliary calculi. Salivary calculi	66 to 83
---	----------

ON

CALCULOUS CONCRETIONS.

PART I.

THE term CALCULUS is derived from *calx*, lime; this alkaline earth constituting the basis of most of the calculous concretions met with in animals.

The older veterinary authors are particularly barren of information of any value respecting these bodies; yet the ancient physicians were well acquainted with them, and by them they were designated Bezoar stones; a Persian name, signifying a destroyer of poisons. This circumstance alone affords ample proof of the estimation in which they were once held. It is true, the term was first applied to a concretion met with in the stomach of a goat inhabiting the mountainous parts of Asia; but, subsequently, it was extended to all similar masses met with in the stomachs of other animals. Extraordinary, and indeed almost miraculous, properties were at one time believed to be possessed by these bezoars; and so efficacious were they considered, that they were worn by the superstitious as amulets, or charms, for the purpose of warding off infectious diseases, and preventing the influence of demons. It is recorded that as much as nearly £300 has been given for a true oriental or Eastern Bezoar; and in Holland and Portugal they were hired, during the prevalence of an epidemic, for a ducat a day. I remember, during my apprenticeship, that a small one was very carefully kept in a box lined with silver-leaf, and often did I turn the mysterious talisman over in my hand somewhat a sceptic as to its powers. I do not recollect having used any of it medicinally, although I have met with old prescriptions in which bezoars have been ordered. Two or three years since, I attended the sale of a private museum in George-street, Hanover-square, where one of these so called bezoars was to be sold. Curiosity tempted me to read the manuscript that accompanied the calculus, which appeared to me to be the half of a large one taken from the intestines of a horse. It stated that its owner had been once offered 100 pieces of gold for it, value £66; that it had been tried both by fire and water, and found to be a true bezoar, therefore his executors were to do what they pleased with it. Enormous masses of calcareous matter have been met with in the elephant, the rhinoceros, and the

hippopotamus: those from the porcupine were highly prized, and kept in spheres made of silver wire.

From the high prices obtained for these accumulations, spurious or fictitious bezoars soon found their way into the market. These appear to have been composed of carbonate of lime, procured from lobsters' claws and oyster-shells, levigated on porphyry, and made into a paste with gum-water, adding a little musk and ambergris to give to it odour. I think I need not add, that neither prophylactic nor medicinal properties are now ascribed to these concretions beyond what their constituents are known to possess; and yet the Schah of Persia sent three bezoar stones to Buonaparte as a present; one of which was composed of fragments of wood, and another of a peculiar resin. The composition of the third is not stated.

But although calculi have failed any longer to be estimated by the credulous for their alexipharmical virtues, yet they still continue to awaken the interest of scientific men; and as many of them exist in those animals which come under the care of the veterinary surgeon, I have thought that a general view of them may not be unacceptable, inasmuch as I shall attempt a condensation of most that has been written respecting them, and particularly dwell upon such cases as have fallen under my own notice. Their formation opens a wide and beautiful field for physiological inquiry, nor can the investigation fail to reward the inquirer. In them we see how chemical laws obtain when the vital functions are impaired by disease; how the molecular forces are in operation, separating the solids from the fluids, and, by uniting particle to particle within the living frame, form the immense accumulations that are before me. We have also proof given of the preservative powers of nature; and thus is shewn how necessary it is that both chemical and mechanical laws should be under the control of those of life, or the admirable and no less wonderful system of organization would soon be destroyed.

This control of the vital functions over chemical laws is, however, more seeming than real, for there is an admirable union and a mutual subserviency between them conducive to the well-being of the animal frame. Were it otherwise, we should not have that beautiful order and arrangement which we at present perceive to exist. The powers of assimilation and secretion would be often checked or irregularly performed, from that which is aliment not being caused to undergo the necessary changes, so as to convert it into blood, without which fluid animate existence must soon cease. We also know that even inorganic substances are taken into the blood, and perform an important office in this fluid, for by them many parts are built up, and maintained in health; while, on the other hand, in the destruction of parts we observe the prevalence of chemical laws acting not only unopposed by those of vitality, but in perfect concurrence with them, and both

co-operating to keep in order the complicated machine, which, when we examine, we are compelled to exclaim with the poet,—

“ Strange that a harp of thousand strings
Should keep in tune so long.”

For the better ordering of my subject some arrangement is imperatively called for:—

“ Affert maxime lumen memoriæ ordo.”

I therefore propose to place calculous concretions under three general heads, some of which may admit of subdivisions :

1. Those found in the alimentary canal :

- a. Stomachical.
- b. Intestinal.

2. Those met with in the urinary organs :

- c. Renal.
- d. Vesical.

3. Casual or occasional calculi, including those formed in the salivary glands and ducts—in the lungs, liver, and other parts.

For the origin of such as are met with in the stomach and intestines, we must look to the food and a derangement of the function of digestion.

STOMACHICAL CALCULI.

Horses affected with bulimia will eat earth, stones, and various other matters ; but such substances do not constitute true calculi, nor will they ever become converted into them.

Millers' horses are said to be very liable to calculous concretions in the stomach, arising from their being fed on refuse bran, or pollard ; their nuclei consisting of pieces of granite or grit from the millstone, or some adventitious substance that has been swallowed. One of my late resident pupils, Mr. H. Taylor, of Sheffield, informed me he had in his possession two taken from one of his father's horses. But the most interesting on record are those which more immediately were the cause of this thesis being written.

In the Proceedings of the Association for the past session, 1840-41, appeared the following from Mr. W. Stanley, V. S., Leamington, Warwickshire :—

“ Last week a bay cart-horse, the property of a miller, was attacked apparently with spasms, for which I treated him in our usual way. The animal not being in such violent pain as some are, and the paroxysms coming on only at lengthened intervals, I left some medicine, thinking he would soon recover. In forty-eight hours I received a message saying, the horse was still in great pain, and that he had not voided any fæces. Upon seeing

him, and more minutely investigating the symptoms, I began to fear that there was something wrong going on. He had never rolled, and scarcely lain down, except for an hour or so in the day: no tympanitis was present, and a bystander would think there was little or nothing the matter. But there was a peculiar symptom about him I did not like, which was that he sighed, drew himself up in a heap, and groaned. He continued in this state for six days, during which time I gave him aloes, oil, and croton, with the usual antispasmodics; and I likewise bled him freely. No fæces were voided during the six days, but on the seventh day he purged, and the owner thought all was going on well. On the following morning, however, he died. On a post-mortem examination, two large calculi were found in the stomach, one weighing above four pounds, the other about five pounds: the latter was wedged in between the duodenum and the pyloric orifice of the stomach, and was the cause of inflammation and death."

One of these calculi Mr. Stanley kindly presented to the Association, and it is before you. A section having been made of it, you perceive its nucleus is a nail. In a subsequent letter he says "It was a singular case. The horse was looking as healthy as could be desired previous to the attack. The rectum was empty from the first day, and one's hand could not be passed above a foot up it. At one time I thought there was a stricture of this gut. During the week he drank his water, and ate grass, and occasionally a little mash. I have before remarked that a casual observer would think nothing ailed him, but after the third day I had no hopes. The duodenum was found in a state of gangrene to the extent of about two feet: but the lining membrane of the stomach was very little inflamed; I should say not at all from the calculus; all that existed being caused by the medicines given. I believe the existence of two such calculi in the stomach is rare. Instances of single ones are more common: I have one in my surgery given me by my late friend Mr. Armstrong, V.S., of Birmingham. It was taken by him from a miller's horse, and in appearance it is similar to the one sent you. My father-in-law, Mr. Rose, has another also taken from a miller's horse, by his late instructor, Mr. Palfrey, of Worcester. My opinion is, that if millers' horses were always opened that have become aged, and were fed upon vitiated bran, and such flour, &c. as is not saleable, these concretions would more frequently be found."

I cannot take upon myself to assert that this may be taken as a type of the calculi usually met with in the stomach of the horse. It may, however, be described as follows:—

FORM, globular: *External surface*, roughened and of a brown colour: *Odour*, scarcely any: *Structure*, a series of concentric layers arranged around a central nucleus, which is in this instance a portion of a nail. Spec. grav. 2.35. *Composition*: The phos-

phates of ammonia and magnesia, a small quantity of silica, and mucus.

The composition of these concretions enables us to trace them to their source. In the cereal plants certain of the phosphates are met with, and that in somewhat considerable quantities. It is, then, to the food, as I have before said, that we are to look for their origin, coupled with a morbid state of the digestive function, by which it does not undergo the necessary change; probably from the succus gastricus not being sufficiently powerful so as to dissolve these phosphates, in which state they must be before they can become assimilated. A foreign body being now taken into the stomach, which may be a nail, a piece of wire, or a pin, or a portion of granite, quartz, glass, or any other substance, it serves as a common centre around which the phosphates arrange themselves in thin lamellæ by the exertion of the force of attraction; and by doing so they blunt that which by its sharpness would wound the lining membrane of the alimentary canal, or by its asperities excite in it a high degree of inflammation. Here we have a beautiful exemplification of the preservative powers of Nature in guarding those parts from injury which are essential to the well-being of the animal economy. This was admirably shewn in a specimen many years since presented by me to the Museum of the College, in which a very large pin constituted the nucleus of a calculus that was being formed. The two extremities were most perfectly obtunded by a deposition of earthy matter upon them, while the middle portion had received but little of it.

By my analysis of the stomachical concretion, the phosphates will be seen to be those of magnesia and ammonia; and Liebig, in his admirable Treatise, titled *Organic Chemistry in its Applications to Agriculture and Physiology*, states that "Phosphate of magnesia in combination with ammonia is an invariable constituent of the seeds of all the grasses. It is contained in the outer horny husk. The bran of flour contains the greatest quantity of it. It is this salt which forms large crystalline concretions, often amounting to several pounds in weight, found in the cæcum of horses belonging to millers."

As to their formation, one of two views must be accepted. They are either the result of a morbid secretion from the alimentary canal, or of some of the glands emptying themselves into it; and the pancreas has been known, under certain conditions, to pour out an increased quantity of its peculiar fluid, from which the phosphates, being in excess, are precipitated. Or, as I have already stated, the phosphates contained in the food have not undergone assimilation.

With the latter opinion I am rather inclined to agree, because we often find such substances entering into the composition of stomachical calculi as could not by possibility have found their way

into the blood, or have been secreted from it; such as minute particles of silex, scales of bran, &c., and these all obeying the laws of aggregation. Beside, it appears to me to be but consonant with Nature's other acts; namely, that if an offending body, and one that is indigestible, be swallowed, she should, in the stomach, commence the means of preventing it from doing any injury. Not that it follows, of necessity, that every intestinal calculus must have its origin in this viscus. We know, indeed, the contrary to be the fact, for oftentimes we find substances such as I have referred to passed onwards into the intestines, where they will accumulate, or are at once expelled from out the system; but when a nucleus has, from its peculiarity, been detained in the stomach, the first layer of the phosphates is there deposited around it, and, being now less likely to cause mischief, it is allowed to escape through the pyloric opening of the stomach into the small intestines, and thence into the cæcum or colon, where by longer detention accretion takes place, until it attains considerable size, or is dislodged.

But if from its magnitude it is unable to pass through the pyloric opening of the stomach, then that organ becomes its nidus, where, by gradual accumulation, it acquires greater bulk. If we do not accept this view, how are we to account for the formation of stomachical calculi? Such cannot be formed from the pancreatic juice; nor can we suppose that, by an anti-peristaltic motion, they have been forced from the intestines after their formation into the stomach. And I am bound to receive as true the statements that are from time to time made by veterinary surgeons, of calculi being found in the stomach of the horse. In the instance of two being met with, as recorded by Mr. Stanley, I have been extremely particular in ascertaining from him whether he took the concretions out of the stomach himself, and he has repeated his assurance that he did.

It unfortunately happens, that the indications of the existence of a stomachical calculus are not more obscure than are our means of removal difficult. Its extraction by an operation, I need not say, dares not to be attempted. Its solution is likewise impracticable; although, if we were convinced of its presence, we might try what would be the effect of lactic acid upon it, which freely dissolves the phosphates out of the body. And if we were to attempt its dislodgement, and to hurry it onwards by purgatives, we might then cause it to become fixed in some narrower part of the alimentary tube, where, by its obstruction, it would cause inflammation and death. I am therefore compelled to confess to you, that I am altogether at a loss to point out a mode by which we can remove a calculus when thus situated. The only precautionary measure we can adopt, is the avoidance of that kind of food which is known to give rise to these concretions; and the state of the egesta of those animals who are of necessity fed upon such provender should be from time to time noticed.

The finding of calcareous and sabulous matters in the stomach of voracious feeders is by no means uncommon; for to allay gastric irritation, horses will sometimes eat strange stuff. Not long since, a patient was in the infirmary, the lining membrane of whose mouth and fauces was in a state of extensive and deep erosion, from his having swallowed some pearlash that was kept in an open cask in the owner's yard. And when experimenting on certain medicaments, to ascertain their influence, I have witnessed an irresistible desire on the part of my patients to eat any and every thing within their reach. A very singular case of a "depraved feeder" is related in *The Veterinarian* for 1837. We are told that "neither manger, nor rack, nor the fragments of the bars, escaped him. He gnawed his halter, licked the walls, and ate up all the earth he could get at. This animal had been the subject of repeated attacks of colic, and which ultimately caused his death. In his stomach were found four pounds and a half of earth and sand. On the morning of the day on which he died he escaped from the groom and galloped to the riding-school, where he was found eating the earth and sand composing the floor."

STOMACHICAL CALCULI IN RUMINANTS.

GLOBULAR MASSES OF HAIR, usually designated hair-balls, are common in the first division of the stomach of the calf. These are very correctly designated hair-balls, being formed from hair which they obtain by licking themselves or each other, and which felts into a round mass, there being seldom any nucleus. As the process of digestion becomes perfect, they disappear from the rumen, and are met with in other compartments of the stomach, and occasionally in the intestines, where they soon become encoated with the phosphate of lime and mucus, and acquire a dark brown appearance.

Mr. Youatt, our almost only authority in these matters, under the head of

CONCRETIONS IN THE RUMEN. says, "They are generally round, but occasionally of various forms, and varying likewise in weight from a few ounces to six or seven pounds. The composition of these balls is also very different. Those which are decidedly peculiar to cattle are composed entirely of hair matted together by the mucous secretion from the follicular glands of the stomach. Sometimes they have no distinct central body; at other times it exists in the form of a bit of straw or wood, or frequently of stone or iron. They exist in the rumen, and in the abomasum. In the abomasum they are composed exclusively of hair, irregularly matted and held together by the mucus of the stomach. In the rumen there is generally a mixture of food or earthy matter in the composition of the concretion. When simple food mingles with the

hair, the ball seems to be formed by a succession of concentric layers, and in the centre is a bit of nail or stone; or if the beasts have access to running water, a piece of shell often constitutes the nucleus."

For further information, I would refer you to Mr. Youatt's valuable work on Cattle; the first attempt made, that I am aware of, to give to this too long neglected division of veterinary medicine a scientific form.

That cattle, under certain conditions of the stomach, will swallow much indigestible matter, is proved by many instances on record, and from the effects produced in the neighbourhood of lead mines; also from a case related by Mr. W. A. Cartwright, of Whitechurch, in *The Veterinarian* for September last, in which he states that in the second stomach of a cow "was found ten pounds weight of stones, varying in weight from two ounces and a half downward. Some were two inches and a half long, but the greater number were flat, as if from attrition. . . . The stomach was literally filled." Some of these I endeavoured to obtain, but I applied too late; Mr. Cartwright informing me they were thrown away. He, however, is of opinion they were taken in with the animal's food, and not formed in the stomach.

INTESTINAL CALCULI.

The following division of these concretions may, I think, be advantageously made.

1st. Such as consist principally of the ammonio-magnesian phosphate, with the phosphate of lime and animal matter; or, *triple phosphate calculi*.

2d. Such as consist principally of the hair of the oat with similar phosphates; or, *oat-hair calculi*.

3d. Mixed calculi, commonly called dung-balls.

1.—*Triple Phosphate Calculi.*

By far the greater number of intestinal calculi that are met with will be found to be thus constituted. The remarks previously made on the origin and cause of stomachical calculi may apply here. The phosphates are obtained from the provender not having undergone solution and entered the blood, from the digestive function being impaired.

But, perhaps, it will be required of me to explain more fully than I have yet done why I do not, with Fourcroy and others, accept the view they take of these concretions being merely a de-

position from the pancreatic secretion. My reason is, that no analysis of this fluid gives the phosphates of ammonia and magnesia as entering into it, while we find both of them in the food, and that in large quantities.

Leuret and Lassaigne analyzed the pancreatic juice of the horse, and found it to contain—"water, 99.0; animal matter soluble in alcohol, animal water soluble in water, traces of albumen, mucus, free soda, chloride of sodium, chloride of potassium and phosphate of lime, 00.9." From hence, in all probability, it is we obtain the phosphate of lime which enters into the composition of intestinal calculi. But it will be observed that none was found in the stomachical calculus analyzed by me. I therefore conclude that this is superadded to the phosphates derived from the food. It may, however, be asked, How it is that these concretions are met with most commonly either in the blind pouch of the cæcum, or in the colon near to its flexion? And this can only be answered by referring to the physiology of the intestines. It would appear that in the horse much of the process of digestion goes on in the divisions adverted to. In man, and many other animals, but little more than fæcation takes place in the larger intestines; whereas in the horse, to prevent the inconvenience that would arise from food being retained in the stomach for a long time, he is furnished with a large alimentary tube, in which, by detention, and the necessary changes produced by the secretions, the chylickation of the ingesta is perfected.

These calculi vary very considerably both in *size* and *number*. You perceive that they are from the bulk of a small pea to that of a man's head, the largest of those before you weighing twenty-four pounds. Sometimes only one or two will be found, and this is commonly the case with the larger ones. Occasionally such impaction themselves in the sacculi of the intestines, and remain there altogether harmless, giving no signs whatever of their existence. At other times they become dislodged, and cause much irritation and colicky pains, followed by inflammation and death. Now and then they have been voided with the excrement. Here is one that was presented to me by Mr. Mogford, of Wycomb, and another was sent to the Association last session by Mr. Stanley.

THEIR FORMS will depend, in a great measure, upon their number. Where only one is present, the attraction of aggregation would appear to go on uniformly all around: particle follows particle, and layer succeeds layer, until a large globose mass results; but when two or more are met with, by compression, and arising from their plasticity when first formed, they become angular, or are flattened. On making a section of such, it will be observed that there had been a tendency to the globular form in the first instance; but this has been interfered with. In one case that came under my notice, no less than 120 calculi were found in the

colon, of various shapes, and differing in size from a closed fist to that of a marble.

THEIR STRUCTURE is singularly uniform, and, I may even add, beautiful. Make sections of as many as you please, and you will find them nearly all alike. Some adventitious substance exists in the centre of each, around which the phosphates have arranged themselves in equidistant circles, or in lines radiating from a common centre, these only to be interfered with by the mechanical action that may be induced by the vermicular motion of the intestines. Some difference in colour of the layers will be seen, the darker alternating with the lighter. I am rather inclined to think that this depends upon a modification of the attractive force. In the one we have the particles assuming the crystalline form; in the other they appear but loosely aggregated. Probably here, too, would be found the greatest quantity of animal matter, which is mucus from the intestines, and which assists in perfecting the bond of union.

THEIR DENSITY is by no means uniform. Some on their external surface are pale-coloured and friable, breaking off in scales; others are dark-coloured, hard, smooth, and polished, as if recently taken from the hands of a lapidary.

THEIR COMPOSITION.—The following has been given as an analysis of one examined by M. Girardin, and which he describes as being of a triangular form, externally of a light colour, and smooth; internally of a crystalline texture, the lamellæ being disposed in radii diverging from the centre to the circumference; colour, brownish yellow; spec. grav. 1.741.

Ammoniac-phosphate of magnesia	48.
Phosphate of lime	19.
Water of interposition	14.
Animal matter	0.80
Matters soluble in water, (soda, sea-salt, alkaline carbonates, and salts of lime and magnesia)	6.60
Extractive matters, soluble in alcohol ...	4.
Fatty matter	7.
Loss	.60
100.	

Altogether, these concretions constitute a pleasing and a profitable subject for investigation, since chemical, mechanical, and vital laws are operating in their formation; and yet effectually to combat the evils resulting from their presence we have no certain means. It may be also said that we cannot with certainty determine upon their existence. It is true, all is conjecture here; but were it otherwise, their ejection is next to a hopeless task:

unless it be, that by the natural action of the intestines they have been passed onwards into the rectum for expulsion; and even here they sometimes become so firmly impacted as to resist all mechanical means of withdrawal.

There is lying upon the table a beautiful morbid specimen, kindly and opportunely sent by Mr. Field, in which you perceive the lodgement of a calculus in the rectum has been the cause of a rupture of that intestine, and, of course, death.

The history of the case, as communicated to me by Mr. Field, briefly given, is as follows:—A favorite mare of his lady's had of late acquired a little too much fat, and, although apparently in a state of perfect health, he thought a dose of purgative medicine under such circumstances might prove beneficial to her. It was given, and had nearly "set," when early the next morning, on his entering the stable, he was informed by the groom that the mare did not appear well, and had refused her food. Upon examination, he at once pronounced the case to be a hopeless one. The symptoms, however, were by no means urgent. She had not lain down, nor had she pawed the litter as if in pain; but there was an irregularity of the pulse, with a somewhat disturbed respiration; the visible mucous tissues were a little injected, perspiration bedewed the surface of the body, a frequent shifting of the position of the hind feet was observed, with much dejection of the countenance, frequent sighing, and a peculiar sourness of the mouth. Mr. Field from these indications prognosticated the existence of some obstruction of the bowels, and which he felt convinced he should not be able to overcome. However, he had recourse to the usual measures, and with difficulty abstracted a small quantity of blood, but without affording any relief whatever. The mucous membranes gradually became blanched, the extremities chilly, and at length of a deathly coldness; a clammy sweat now broke out, and within six hours from the first appearance of indisposition the animal died, and that without having experienced any very considerable amount of suffering.

On laying open the abdomen, a quantity of blood was seen within the cavity, and which was found to have escaped from the bloodvessels of the rectum, this intestine being ruptured, as you see it before you. Every other viscus in the body was in a perfectly normal condition. Further comment by me is uncalled for, since the morbid part speaks for itself.

A case analogous to this of Mr. Field's was related to me by Mr. Jones of Worship-street. The horse was attacked with symptoms indicative of inflammation of the bowels, for which the usual remedies were unsuccessfully employed by him. After death he found the rectum ruptured by the contraction of the muscular coat of this gut upon a calculus of some size, and upon further examination he removed eight other calculi from the colon.

But little more need be said under this head. I would, however,

repeat the statement before made by me, that the earthy and other matters taken into the stomach and intestines never form true calculi; both the structure and composition of these concretions disprove this opinion; nevertheless it is certainly from without that they obtain their various nuclei.

II.—*The Oat-hair Calculus.*

Concretions of this kind constitute a very interesting class, and their appearance is varied, for sometimes the vegetable matter predominates, and at others the earthy. Rarely ever in these do we meet with that regularity of structure which is seen in the calculi already commented on. Occasionally there seems to be an attempt made to attain it, but it is prevented by the interposition of vegetable fibres. Now and then a small ammonio-magnesian phosphate calculus will be found imbedded in a mass of the felt-like material, or several of them may be thus aggregated together; and still less frequently the felt-like substance will be seen encoated with a layer of the ammonio-magnesian phosphates.

Most commonly the external surface of these masses is tuberculated, and their forms very irregular. Their constituents are evidently derived from the aliment, and they have seldom any distinct nuclei.

They have been called *dung-balls*, and *dust-balls*; which terms being inexpressive of their composition, I would suggest that they be designated

OAT-HAIR CALCULI

Some years since I was examining a calculus that presented a somewhat unusual appearance. It was about the size of a cricket-ball, and slightly roughened on its outer surface. On breaking it in order to ascertain its structure, and what constituted its nucleus, there slipped from out of its centre a mass about the size of a horse chestnut. At first sight this struck me as being a portion of scybala, which by long retention had become encoated with calcareous matters. On closer inspection, however, I found it to consist of the felted substance so abundant in what are termed dung-balls. Placing a little of it under the microscope, I perceived it to be made up of minute hairs, terminating in sharp points, and which bore, I thought, a close resemblance to the hairs that are seen investing the oat after the glume has been removed from it; and in comparing portions of each together, I could detect no dissimilarity. Their identity has since been fully confirmed. The harder parts of the calculus, to the amount of about one half, I found to consist of the ammonio-magnesian phosphate and animal matter, principally inspissated mucus.

Dr. Maclogan has lately given a more minute analysis of one, which he says proved fatal to a horse by obstructing the small (?) intestines. It was as large as two closed fists, and weighed rather more than eight ounces. The surface was lobulated, and covered in many places with patches of light brown crystals. These, as well as the greater proportion of the earthy matters, consisted of the phosphates of magnesia and ammonia. The bulk of the mass was made up of the hairs and husks of oats. The composition of the whole was as follows:—

Organic matters and moisture	52
Soluble salts	8
Phosphate of lime	6
Ammonio-magnesian phosphate	28
Silica	6

100

The circumstance that first led me to examine this velvety or felted matter was a knowledge of the fact, that the late Dr. Wollaston had met with the like substance in the human subject, the nature of which had much perplexed several investigators. It appears that he was led to form his opinion of it from a hint received from Mr. Cliff, who, in the course of conversation, asked whether this fibrous matter might not proceed from oats? Dr. Wollaston was thus induced to examine the hairs of the oat, and comparing them with some obtained from the calculus, fully verified Mr. Cliff's conjecture.

After having given publicity to the composition of these concretions, I was informed that Professor Dick taught the same in his lectures. I, therefore, felt a pleasure in being able to confirm the correct views he had taken.

Perhaps I have here applied the term *felted* incorrectly, as the microscope does not shew the hairs to be barbed or serrated; and the question naturally arises, How, then, are they held together? This Mr. J. de Carle Sowerby has solved, by ascertaining that they are slightly spindle-shaped, contracted at their base, and at their origin from the investiture of the oat, by incurvation they form a small hook, which is rendered more perfect by their having a bulbous extremity. I am not aware that these facts have been before noticed; but they at once enable us to explain the cause of the formation of masses by them, as well as the lobulated or tuberculated exterior the true oat-hair calculus is almost always found to possess.

You will perceive by the specimens before you, how large a size these concretions will attain, and how multiplied are their forms.

I need hardly add, that such oats as are very husky and possess many of these hairs, with a deficiency of farinaceous matter, are

likely to give rise to these accumulations whenever impaired digestion exists; or the latter may be even produced by them, thus laying the foundation of a train of maladies, among which may be enumerated crib-biting and its consequences, a subject, I have much pleasure in informing you, that will shortly be brought under your consideration by the Club of United Veterinary Surgeons, a committee having been appointed, at whose head is your worthy President, to institute the necessary inquiries. Thus, we may confidently hope, a question that has long divided the professional public will be satisfactorily settled; for I know not of so sure a way of effecting this as by co-operation; and when the members of a medical club unite for this purpose, good will assuredly result from their endeavours, while they will be justly esteemed by their brethren for their labours' sake. Already we have received the first-fruits of this united body in a paper on Torsion; and now we are about to gather in of the rich harvest that remains, as was predicted.

III.—*Mixed Calculi.*

The third and last kind of intestinal calculi met with in the horse, and which will not come under either of the two other divisions may, perhaps, be designated DUNG BALLS; but I have ventured to call them MIXED CALCULI. They are made up of coarse, indigestible, excrementitious matter, mixed with portions of the calculi already described, and many foreign substances, such as pieces of coal, gravel, &c., the whole being agglutinated together by the mucus of the intestines; and they are most commonly met with in horses that are voracious feeders. Mr. Bowles, of Abergavenny, states that he often finds a large quantity of coal and stones in the intestines of horses that work under ground. Probably these labour under gastric irritation from irregularity of feeding, to allay which they swallow any substances that come within their reach. In such cases the aid of antacids is indicated; and I have no doubt but that incipient crib-biting might be often removed by the timely use of this class of therapeutic agents.

But to revert to mixed calculi: and, as illustrative of the effects produced by these accumulations, I will transcribe a case from the College Register.

The patient was admitted into the infirmary labouring under obstinate constipation of the bowels, accompanied with colicky pains. He had frequently been the subject of attacks of spasm, which had as frequently been overcome by the ordinary remedies.

On his admission this time the groom reported that the animal had refused his food in the morning, and was seized with shivers; after which he laid down and rolled as if in pain. The pulse was

50 and full; respiration untranquil; the vessels of the visible mucous tissues turgid; the mouth hot and dry, and no fæces had been voided.

Depletion was had recourse to. Six drachms of aloes in solution were then given, and enemata of warm water thrown up every hour; but no relief was afforded. The animal would lie down and look with anxiety towards his flanks, groan, and suddenly rise again. On passing the hand up the rectum, a few scybala only, encoated with viscid mucus, were removed.

On the following morning the symptoms had become more urgent. The pulse had risen to 60; much uneasiness was manifested; and the bowels had not responded to the aloes. Three drachms more of aloes were now administered in a pint of linseed oil, the enemata were directed to be persevered in, and hot water, by means of rugs, applied to the abdomen, which was becoming tympanitic.

On the second day there was no mitigation whatever of the unfavourable symptoms, except that the pulse was less frequent. The bowels remained obstinately constipated; the clysters were returned unchanged in colour; much pain was still expressed by the animal constantly lying down and rising again, and, when doing so, resting for some minutes on his sternum. The aloes and oil were repeated, and tepid water given by a horn.

In the evening the pulse had again risen, and its character appeared to warrant the withdrawal of more blood, which was attempted; but before any amount could be abstracted, syncope came on. After this had passed off, the animal, while standing would paw the ground with violence, and when lying down rest for some time on his chest, as in the morning.

Viewing it as a severe case of indigestion, it was determined to persevere with the use of purgative agents, and croton farina grs. xxx was given in half a pint of linseed oil, the warm water and clysters being continued.

The next (the third) day the bowels were excited into action, and the egesta was voided in considerable quantities, but unhealthy, the food having been imperfectly digested. Hopes were now entertained that all would be well. In the evening, however, violent catharsis came on; the dejections were profuse, watery, and very offensive; the pulse became quick and fluttering; the extremities chilly; the mouth clammy; and the respiration hurried.

Prepared chalk $\mathfrak{z}\text{iv}$, and opium $\mathfrak{z}\text{j}$, were exhibited in the form of draught; the extremities bandaged with flannel, and thick gruel given by the mouth.

On the following morning (the fourth day) catharsis was still present, and the dejections were highly fætid; much prostration of strength was evinced, with general tremor of the muscles; the countenance became anxious; the pulse irritable, and 100 in the minute. A most violent paroxysm occasionally was experienced,

which always preceded an alvine evacuation, and was followed by a short period of comparative tranquillity. Inflammation of the fore feet (*laminitis*) now set in. The animal was constantly shifting his position; the feet were increased in heat, and a throbbing of the pastern arteries was to be felt; the muzzle and ears were cold, and the mucous tissues highly injected. The draught of chalk with opium was repeated; but all endeavours proved of no avail. In the evening the pain of the bowels returned; the paroxysms became more and more violent; the evacuations, although not so profuse, were highly fetid; a rumbling noise in the intestines was heard as the contents were passed onwards; the pulse became much more accelerated; the respiration laboured; and at length the animal sunk from exhaustion.

Post-mortem examination.—On laying open the abdominal cavity, the large intestines were perceived to have been violently inflamed, and in parts gangrene had taken place. Tracing them throughout their course, within the colon, at its last flexion, a conglomerate mass was found weighing 6 lbs. troy; of which a section being made, it was found to consist of faecal matter, parts of nails, portions of coal, and gravel agglutinated together. A large quantity of partially digested food was by it prevented from passing onwards, with which nails, coals, &c. were found commingled.

This animal had always been a voracious feeder, and the necessity is thus shewn of attention being paid to diet, with the occasional interposition of a dose of purgative medicine.

I need hardly add, that such accumulations as these are only met with in that portion of the alimentary tube where fæcation commences, and oftentimes they attain to a considerable size, causing a mechanical impediment to the passage of the egesta.

Mr. Silvester informs me, that cases have fallen under his notice of large masses formed in the larger intestines by the fibrous parts of old tares mixed with faecal matter, and these, from their bulk and the irritation they produce, will sometimes cause death. Hardened fæces (*scybalæ*) will likewise occasionally excite inflammation in the bowels, or, by producing obstruction, give rise to fatal results, but neither of these come under the head of intestinal calculi.

INTESTINAL CALCULI IN OTHER ANIMALS.

CATTLE.

On the authority of Mr. Youatt, I have stated that various accumulations are met with in the rumen of cattle. He adds, "It is the natural situation for them, for there the food is longest detained, and there they have time to form, as in the colon and caecum of the horse. A few, but much smaller, calculi are occasionally found in the reticulum; others, composed of thin and friable con-

centric layers, occupy, yet comparatively rarely, the large intestines of cattle; but they are not of great size, for the food passes too rapidly over the smooth surface of these portions of the digestive canal. There are no symptoms by which their presence can be recognized, nor is there any evidence of their being a cause of disease, although it is not improbable that the presence and pressure of these bodies, and the irritation produced by them, may in some instances be the cause of colic, strangulation, and other serious affections."

SHEEP.

Sheep have been known to pass calcular concretions; they consist principally of vegetable fibre and carbonate of lime.

THE DOG.

"There is hardly any cavity of the body of the DOG," says Mr. Blaine, in his invaluable *Canine Pathology*, "in which calcareous matter has not been found; as in the brain, in most of the glands, and in the intestines, where occasionally considerable masses have been detected, some of which had formed themselves a sac, by distention of the intestinal coats."

PART II.

URINARY CALCULI.

It having been enunciated that the animal organism is incapable of generating a single elementary substance, we must look for the constituents of all the compounds met with in the frame to materials received from without the body.

The many glands and organs of which it is composed have their several uses, each being destined to perform its part; and among them the kidneys hold an important station. Their office is to separate from the arterial blood, in the form of urine, that which, if retained, would prove prejudicial to the animal economy; and also to remove effete materials from the body, by which they become emunctories to the system. These consist principally of nitrogenized compounds resulting from the metamorphosis of the organized tissues; and among them we find UREA and the HIPPURIC and URIC ACIDS. To the first named, urine is said to owe its characteristic properties. Its composition is thus given by Liebig:—

Urea.

Carbon	20.192
Hydrogen	6.595
Nitrogen.....	46.782
Oxygen	26.425

or calculated C2, H4, N2, O2.

To the transmutations of this principle in urine many of the compounds met with in this fluid are referrible. Thus, the constituents of UREA being as above stated, if the relative proportions of nitrogen and hydrogen are lessened, and those of carbon and oxygen increased, we have URIC ACID formed, consisting of



And if from this we remove an equivalent of oxygen, we have the uric or xanthic oxide, a species of calculus sometimes found in the bladder of the human subject.

In benzoic acid, another acid met with in urine, as will presently be shewn, we have no nitrogen, its composition being



In urine we also often meet with carbonate of ammonia, and chemistry alone enables us to explain its formation. The composition of urea and hydrous cyanate of ammonia is identical; and if one atom of this principle—urea—combines with two atoms of water, mutual decomposition takes place, and two atoms of carbonate of ammonia are the result. This fact also enables us to account for the formation of other cyanates in the urine, as of potash; while sometimes even free hydrocyanic acid has been met with in this secretion.

The second principle, the hippuric acid, is usually associated with soda, forming the hippurate of soda, and its composition is as follows:—

Crystallized Hippuric Acid.

Carbon.....	60.76
Hydrogen.....	4.92
Nitrogen	7.82
Oxygen.....	26.50

or calculated C18, H8, N, O5.

Besides these we find, in the urine of the horse, the carbonates of soda and lime, and the chloride of potassium; and, in addition to these compounds in the urine of the ox, the carbonate of magnesia, the predominating alkali being potash. Traces of the phosphate of lime have also been met with in both these animals. In the dog, he being a carnivorous animal, we find the uric acid to exist, and the phosphates are very abundant in his urine. "In animals which drink much water, by means of which the sparingly soluble

uric acid is kept dissolved, so that the inspired oxygen can act on it, no uric acid is found in the urine, but only urea."—*Liebig*. So that this last-named proximate principle is the product of the oxidation of uric acid; and "if to one atom uric acid we add six atoms oxygen and four atoms water, it resolves itself into urea and carbonic acid." The formation of oxalic acid may be traced to a change in the same principle; and the production of mulberry calculi, or those containing oxalate of lime—a very uncommon ingredient in concretions taken from the horse or ox, but sometimes found in the dog—are thus shewn to be dependent on a diminished supply of oxygen, that is, less than that which gives rise to the generation of carbonic acid and urea, this being the last or highest product of the oxidation of uric acid. "In birds, which seldom drink, this acid predominates;" and hence the value of guano as manure.

It will be evident, on the slightest reflection, that the character of the urine is liable to undergo changes from very many causes, as, for instance, from the nature of the aliment, the state of the digestive organs and the skin, the condition of the secreting glands themselves, and even the degree or kind of work to which the animal is subjected; since "the hippuric acid present in the urine of the horse when at rest becomes converted into benzoate of ammonia and carbonic acid, as soon as the animal is compelled to labour."—*Liebig*.

Although we are thus enabled to trace the origin of the carbonate of lime,—which oftentimes exists abundantly in our patients, it being frequently voided in such quantities as to render the urine white and opaque, and this when no indication whatever of diseased action is otherwise manifested,—it is, when either functional or organic derangement has taken place, that the more complicated changes are brought about. Then it is that chemical laws have obtained the ascendancy over the vital powers, and the "harp of a thousand strings" is for a time unstrung. From the *comparatively* inartificial state in which those animals live that come under the care of the veterinary surgeon, as contrasted with their lordly master, man, perhaps they are not so frequently the subjects of disease of the urinary organs as he is; nor are the compounds met with so varied. By far the greater number of calculi found both in the horse and ox are composed principally of the carbonate of lime and animal matter. In a few I have detected the phosphate of lime, and in some traces of the ammoniaco-magnesian phosphate. In the dog we find the ingredients to be much more numerous, the reason of which may readily be assigned,—it arises from the nature of his food, and the mode of living, or irregular exercise.

Although I have questioned the frequency of the existence of calculi in the lower animals as compared with man, I at once

express my firm conviction, that they are nevertheless present in them more commonly than is thought; nor is this to be wondered at, when the functional relationship which exists between the kidneys and the skin is borne in mind, coupled with the alterations of temperature and many accidental circumstances, as injuries, &c. to which the horse more particularly is exposed. I come to this conclusion from the multiplied specimens which are being continually brought from the horse-slaughterers' yards to the College; and on inquiry being made, in very many instances we have not been able to ascertain that, during life, the animals shewed any symptoms indicative of their presence. This may, in great measure, arise from the want of observation on the part of their owners, or from the symptoms having been mistaken for spasmodic colic. It is, however, sometimes the case, that indubitable proofs are afforded of the existence of these foreign bodies; but the poor brutes, notwithstanding, have been compelled to lengthen out a miserable existence, until, exhausted by pain, they have become so feeble as to be altogether incapable of further labour.

Leaving the points of disputation respecting the *causes* of urinary calculi, we will be contented with the two already named:—first, the food taken in; and, secondly, functional or organic change in the kidneys, induced by various means: and we propose to consider these concretions under two heads: namely, renal and cystic calculi.

1.—RENAL CALCULI.

The origin of all cystic concretions may be traced to the kidneys; at least there, their nuclei, when present, are first formed. From the horizontal position of the bodies of our patients, these do not find their way down the ureters into the bladder so readily as in man; hence renal calculi are more frequently met with in the lower animals than in him. Frequently, however, they pass onwards with the urinary secretion; sometimes very minute in size, at others the reverse: and who shall say that their passage is not accompanied by the like racking tortures which are known to be attendant on the passage of a renal calculus in man? Occasionally they have become fixed in the ureter, and then they have been designated *URETAL*; but more commonly they remain in the pelvis of one or other of the kidneys, and, diseased action having been thus set up, by their irritation they not only cause its continuance, but increase it; and as particle succeeds to particle, we have at length masses of considerable size formed, which, pressing upon the softer parts, cause their removal, until, occasionally, little more than the cortical portion of the kidney is left. The Museum of the College abounds with such specimens, and

many of them are before me. [See *fig. 1, Pl. IV.*] Unfortunately, the history of the cases in which they occurred we have not been able to obtain, so that they are alone interesting as shewing what may be the result of an abnormal action set up in certain organs of the frame.

In 1839, Mr. J. Bowles, of Ely, placed before the members of the Association a splendid specimen of a renal calculus, weighing twenty-five and a half ounces troy. It occurred in the practice of his late uncle; and in a letter received from him a short time since, in reference to this case, he says, "The subject of it was a post or coach horse, and he was frequently attacked with symptoms which were scarcely distinguishable from those of spasmodic colic; in fact, he was always treated for that disease, and as frequently recovered. The animal, at last, died suddenly, after a severe day's work, and, on opening him, the existence of the calculus was discovered. Of course, nearly the whole of the kidney had become absorbed, so that the other kidney, which appeared perfectly healthy, performed the functions of the two. I had, myself, a case in which there were two calculi, both in one kidney, and also many earthy deposits in the tubuli uriniferi and the ureter, which latter was considerably enlarged; and I have no doubt, had the animal lived much longer, that the whole would have become a consolidated mass of calcareous matter. This animal, also, was frequently attacked with symptoms similar to those of spasmodic colic, although there appeared to be some affection of the kidney or kidneys, as he could not bear pressure over the loins, and he used to stand with his hind legs wide apart, and frequently made efforts to urinate, although his bladder was empty. This was a post horse, and he also died after a severe day's work. The other kidney was perfectly normal."

A calculus of a singular form was sent to the Association during the last session by Mr. W. Smith, of Norwich, which he obtained from a knacker's yard. It was of a triangular shape, weighed twelve ounces troy, its colour brown, structure dense, striated, and crystalline. The kidney containing it was much enlarged, the walls of the pelvic portion hypertrophied, and the whole presented an ulcerated mass. The subjoined woodcut will convey an idea of this concretion.

Fig. 1.



Fig. 1 shews the form of the calculus.

Fig. 2.

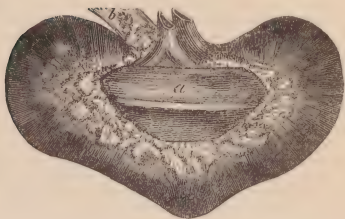


Fig. 2 is a section of the kidney, shewing the calculus in its pelvic portion.

In the bladder was found much sanguineous and purulent fluid mixed with the urine. A portion of both of these concretions I analyzed, and found them to consist of the carbonate of lime, with a little of the phosphate of lime, and traces of ammonia: thus, they differ somewhat from the usual constituents of vesical concretions, there being some of the phosphates present.

The renal calculus I now exhibit has been kindly forwarded to me by Mr. T. Turner, of Croydon. In a letter which accompanied it, he says, "The history of the case in which the specimen sent occurred is meagre, but positive as far as it goes. It was taken from an aged cart-mare, whose death was accidental, and during life no disease of the urinary organs was suspected. A post-mortem examination shewed one kidney to be perfectly healthy in structure, but the other had undergone a strange change. In appearance, the calculus represents a petrified kidney, all the remaining portion being made up of loose sand, and the whole is contained in an investing membrane. Its weight is twenty-three ounces."

This specimen is interesting, as it affords a proof that sabulous or gravelly matter is often formed in the kidney, and not deposited from the urine merely, arising from changes which this fluid may undergo from retention, and other causes.

As it respects the treatment to be adopted for renal calculi, but little can be said, since their existence can only be, at best, conjectural. Their presence would appear to be indicated by pain, which simulates abdominal: but should this be accompanied with an unnatural condition of the urine, for instance, that of a sediment being thrown down on standing, or its being mixed with either blood or pus, and much uneasiness expressed while

voiding it, and the animal experience a degree of suffering from pressure being made over the loins, we may infer the existence of a calculus in some part of the urinary apparatus, and its absence in the bladder and urethral canal will lead us to conclude that it is in the kidney. The means then to be had recourse to, although little more than palliative, nevertheless warrant our employment of them. Our first endeavours should be to allay the constitutional disturbance that has been set up, which may be effected by the timely aid of blood-letting and oleaginous purgatives; and topically we may apply counter-irritants, cautiously avoiding the use of those agents which act upon the kidneys, such as the compounds of turpentine, cantharides, &c. substituting a sheep's skin or a mustard cataplasm, or hot rugs; and probably by the subsequent administration of acids,—of which I shall speak more fully hereafter,—we may cause a disintegration of the calcareous mass, if we do not effect its solution; or, at any rate, we may prevent the deposition of more earthy particles, for it is well known the mineral acids do not undergo assimilation, and that by the kidneys they are eliminated from the system. In a case of poisoning by sulphuric acid, which occurred a short time since, Dr. Griffiths obtained satisfactory proofs of the existence of this acid in the pelvis of each kidney. Need I add that the state of the digestive organs should be most carefully attended to, there being unquestionably a disposition in the system to this unhealthy action, and, by altering the character of the blood, we may prevent it.

CYSTIC CALCULI.

Although an almost uniformity of composition would appear to prevail in these accumulations, yet their structure or physical characters vary. Those which have fallen under my observation are—first, a soft mass of the consistence of paste, and which hardens on exposure to the air; secondly, the same substance more dense, as if the force of cohesion was operating among the particles and bringing them into closer approximation; and, thirdly, that which may be designated the true calculus, dense and compact in its structure, with an irregular or roughened surface, and breaking up into fragments or columnar masses, which have an amorphous appearance, being altogether wanting in that beautiful arrangement in concentric layers and laminated plates which we find in more complex concretions. I place before you many specimens of each of these kinds.

This bladder, you perceive, is nearly filled with a solid mass, consisting almost entirely of carbonate of lime. When first received it was of the consistence of paste: its weight is thirteen pounds and a half. Fourcroy analyzed a similar deposit, and found it to consist of

83	parts carbonate of lime
3	parts carbonate of magnesia
1	part phosphate of lime
13	mucus from the bladder

 100

Doubtlessly the animal in which it occurred must have laboured under incontinence of urine, as but little space exists in the cyst for this secretion to be retained; and when voided it must have been turbid and opalescent from the abundance of earthy carbonates, which might have been easily decomposed by the injection of any weak acid into the bladder, although this would not have checked the disposition in the kidneys, if functionally or organically diseased, to separate more from the blood. In this and many other specimens, there is no tendency to consolidation, much less to the formation of even imperfect crystals.

In the year 1839, Mr. G. Baldwin forwarded to the Association a quantity of sabulous matter weighing eight pounds and a half, which he had taken from the bladder of a horse destroyed on account of old age. During life no urgent symptoms presented themselves, but the animal was observed to urinate frequently, and sometimes it would be interrupted in its flow.

A case was at the same time related by Mr. Evison as follows:

"A horse, six years old, belonged to a farmer in the neighbourhood of Louth. In October 1838, this animal and two others were suddenly attacked with indigestion. They were treated accordingly, and two of them speedily recovered; but this one never appeared quite to regain his former health. He, however, got sufficiently well to be sent to work, soon after which he began gradually to lose condition.

"It was now discovered that the carter, unknown to the proprietor, had given to these horses a quantity of dry wheat. This, I have no doubt, was the cause of their illness, for I have frequently known indigestion to be produced in a similar way.

"Our patient continued at work about a month or six weeks, when his loss of condition and of strength began to be so apparent that he was laid aside. A little before this, also, he had received a blow over the glutei muscles, which caused an evident loss of action, and consequent absorption of them.

"He now began to get very feeble and lame. The owner, however, would not incur any expense in trying to relieve him, but sent him to our infirmary to be destroyed. We kept him about a week, and then put an end to his sufferings.

"The symptoms while he remained with us were, an irritable and rather quick pulse; the conjunctiva and other mucous tissues pale; the animal continually shifting his position, and, particularly, his

hind legs, like a horse labouring under spasmodic colic. In attempting to void his urine, he would stand with his hind legs wide apart, apparently in the greatest pain. A few minutes would sometimes elapse before any urine was voided, and then it was passed in very small quantities, and quite turbid.

“*Post-mortem appearances.*—The viscera of the thoracic and abdominal cavities were healthy, with the exception of the urinary apparatus in the latter. The kidneys were slightly inflamed, particularly the cortical portion. The bladder was distended to three times its natural size, and, on opening it, I found it to contain a considerable quantity of calcareous matter. There was a mass in the centre as large as a cricket-ball, of considerable firmness, and which could not be broken by the hand. The ureters and the urethra contained a portion of the same calcareous matter. They were lined by it: some of it was likewise found in the pelvis of the kidney. The coats of the bladder were considerably thicker than in their natural state, particularly the muscular coat.”

The origin of this sabulous matter has already been traced. Its carbonic acid is derived from the decomposition of the hippuric acid, the base, lime, being obtained from the aliment; the salts of this alkaline earth being abundant in all the cereulea and also the grasses, the common food of our patients. I will not say that some portion of it may not occasionally be derived from the water, since this, in many localities, contains large quantities of lime, and which, undergoing solution in the acid of the stomach, is carried onwards, and excreted by the kidneys.

If those practitioners who reside in the neighbourhood of calcareous springs, such as Matlock in Derbyshire, Bristol, and Bath, would kindly inform us, if, with them, calculi have been more common than with others, it would go far to settle this question; although it is not necessary, as has been already shewn, that the lime must exist in the water.

In the *second* kind, where the molecular forces appear to have been in operation, we have something like areolæ or concentric circles. The section of this calculus [*see fig. 2, plate IV*] shews this very distinctly. I remember when this specimen was purchased it was so soft externally as to yield readily to the pressure of the thumb, but interiorly it was much harder.

Of the *third* kind of calculi very many instances are recorded. Some of these have nuclei, which in our patients, however, rarely differ in composition from the mass, accidental nuclei being very uncommon: this is not the case in the human subject. They appear as if first formed in the pelvis of the kidney, and, having passed down the ureter into the bladder, that there incrementation has taken place. Others, on being cut through, present a rude radiated aspect, still having no distinct nuclei in their centres; and yet, from the arrangement of the particles, one is almost in-

clined to think that some common centre of attraction existed, or something like crystallization had been going on. In nearly all, the outer surface presents many asperities; they are of a brown colour, and when first removed have a urinous odour. In size they vary; the largest on record which has been extracted, that I am acquainted with, is one by Mr. W. Robinson, of Tamworth; it weighed one pound troy, and was forwarded by him to the Museum of this Institution; but, unfortunately, it never was deposited there.

The three calculi before me [*see fig. 3 and 4, plate IV*] have been extracted from patients in the infirmary of this Institution; and the histories of the cases in which they occurred will be given as recorded by me in the College Register, since they may be accepted as typical of all; and my desire is to state only that which I have witnessed under this head, the annals of veterinary medicine being rich in numerous other cases.

1.—CASE OF CALCULUS IN THE BLADDER.

By Professor SEWELL.

1829, *Feb. 14.*—THE patient is an aged hunter, and for some time past, after any undue exercise, he has been observed to pass blood commixed with his urine, followed by painful efforts to expel more: there exists, however, no constitutional disturbance, the pulse being of the healthy standard, and the appetite good. Of late the quantity of blood that is voided is greater than it was, which is supposed to arise from a fall. Place the animal on diet of mashes, and occasionally exhibit a dose of aloetic medicine.

Feb. 26th.—After careful and repeated examinations of the bladder by rectum, the existence of a calculus was ascertained, and the operation of lithotomy determined on as the only means of affording permanent relief, since, although all unfavourable symptoms are mitigated, they continue present in degree. The bowels being in a relaxed state from diet and medicines, the animal not suffering the least in general health, and his condition not being plethoric, the present was considered a favourable time for the operation.

Professor Sewell having the animal cast and placed on his back, the hind legs being drawn forward to his shoulders, and properly secured in this position, proceeded to operate. A whalebone staff was passed up the urethra as far as the perineum: a free incision was then made with a common scalpel through the integument, through which a sound was passed into the bladder, when the stone was very distinctly felt. The forceps being introduced, Mr. Sewell

at once obtained a firm hold of the calculus; but, on attempting its withdrawal, it was found too large to pass out through the neck of the bladder. The hold was therefore loosed, and, by means of a probe-pointed bistoury, a lateral incision was made in the neck of the bladder. The forceps being again passed in, as firm a hold as at first was obtained of the stone, but, from the roughness of its surface, several efforts were made before it was withdrawn: at length it was got without the bladder, and nothing more was necessary than to dilate the external wound, and employ a moderate degree of force to extract it entire.

The operation occupied about twenty minutes, and from eight to ten ounces of blood were lost.

The bladder was washed out by injections of warm water, which brought away several fragments of the stone: the divided vessels were secured, and the lips of the wound brought in apposition by three sutures.

The animal, after the operation, appeared unaffected. The calculus weighed nearly three ounces, being of an oval form, and rough externally. [*See fig. 3, plate IV.*]

Two hours after the operation, pulse 32, legs and ears cold; except which, no unfavourable symptom is present. Bandage the legs with flannel, and let the animal remain quiet. Diet mashes. In the evening some urine was voided, which was tinged with blood from the wound.

Feb. 27th.—The parts are swollen, and during the night there has been an escape of urine through the wound: pulse 32, and animal lively.

6 P.M.—During the day the animal has lain down, but the pulse is quicker, being 44. Give aloes $\frac{3}{4}$ ss, and throw up an enema. The urine flows at first through the wound, and afterwards through the natural opening.

10 P.M.—The animal is lively, and manifests no uneasiness, yet the pulse continues to rise, being now 48. Take blood 6 lbs., and repeat the clysters.

28th.—Pulse 40. Wound slightly fetid. Dress with equal parts of oil of turpentine and olive oil. Diet to consist of mashes and sliced carrots.

March 1st.—Pulse 44. The laxative ball and clysters to be repeated. Dress wound as before. Except the slight acceleration of the pulse, no unfavourable symptom is present.

2d.—Pulse 42. The wound discharges pus: some of the urine passes through the wound, but the greater part naturally.

4th.—Bowels torpid. Give aloes $\frac{3}{4}$ ss in ball. Repeat the clyster. The discharge of pus is more healthy, and less urine passes through the wound.

7th.—Pulse 40. Repeat the aloetic ball. Healthy granulations

are fast filling up the wound, but the urine still passes through it in small quantities.

9th.—Pulse 38. Limited diet as before.

12th.—Pulse 36, and otherwise the animal is in as favourable a state as can be desired.

14th.—Pulse 34. The urine now flows in an uninterrupted stream through the natural channel, and the external wound is fast healing. Diet, bruised corn with mash, &c.

16th.—Applications to wound discontinued.

18th.—Pulse 32. Quantity of corn to be gradually increased, and animal exercised. Wound healed.

April 2d.—Discharged.

About three months after this, the urinary organs were forwarded to the College for examination, and the owner reported that incontinence of urine had existed, and latterly the animal had fallen away in condition—he was therefore induced to have him destroyed. The coats of the bladder were found thickened, but the wound in its neck had perfectly healed. The right kidney and ureter were enlarged, and contained pus; several small calculi were in the pelvis of the kidney, and one of a larger size was impacted in the ureter: had this been passed into the bladder, in all probability it would have become the nucleus for another vesical calculus.

2.—CASE OF CALCULUS IN THE BLADDER.

By Professor SEWELL.

(Accidental Lithotriety.)

1833, Sept. 22d.—THE animal makes frequent attempts to void his urine, which he effects in small quantities, and with pain, its flow being interrupted. During the act the pulse rises, and continues accelerated for a short time afterwards; it then falls to 40 beats in the minute. These symptoms have been present for some months, but are unaccompanied with any marked constitutional derangement, the animal being lively, and his appetite and condition good.

These symptoms indicating the existence of a calculus, the flexible catheter was introduced, which having a metallic end, it was heard to strike against the stone. Prior to this, examination per rectum had been resorted to, and the result was a confirmation of the suspicions first awakened: indeed, the proprietor has for some time past thought that a calculus existed, and has exhibited dilute

hydrochloric acid, by the advice of a veterinary surgeon, with a view to effect its solution, but hitherto it has proved ineffectual.

Place the animal in a loose box, on diet of mash, and give aloes ʒv, in ball.

23d.—Let enemas of warm water be thrown up. The faecal matter is becoming soft by the aloes.

24th.—The efforts to void urine are become more frequent, and also more painful. The bowels are still relaxed. Diet of mash continued.

27th.—The operation of lithotomy was performed by Professor Sewell. The animal being cast, his hind legs were drawn forwards, and he was properly secured in this position. A whale-bone staff being passed up the urethra, as in the former case, an incision was made down upon it, and through the opening thus made a sound was introduced into the bladder, and all suspicions set at rest by its coming in contact with a calcareous mass. The sound being withdrawn, the forceps were passed into the bladder, aiding their introduction by the hand passed up the rectum, and, on opening and again closing them, the stone was firmly grasped: on giving moderate pressure, so as to insure its withdrawal at once, from its fragile nature it was broken into several pieces; it was, therefore, withdrawn in fragments. The largest piece abstracted was about the size of a nutmeg, quite sufficient to shew the nature of the concretion, and other portions were subsequently taken away, until four ounces of calcareous matter were obtained. Injections of warm water were now thrown into the bladder, until they returned free from any debris, thus affording assurance that none of the calculus remained behind. The patient being allowed to rise, he seemed to have suffered but little from the operation, nor was the quantity of blood lost at all considerable. After being returned to his box, the pulse became a little accelerated, and remained so for some hours afterwards; but by 10 p.m. it had fallen to 36, and he appeared lively. Ordered the parts to be kept clean. Diet restricted to mash; and aloes ʒiij given in a ball, with occasionally a clyster.

28th.—Pulse 32; animal lively, and feeding well on allowed diet. Not the least unfavourable symptom is present. A small quantity of urine only passes through the wound in the perineum, the greater portion being voided by its natural channel, and in a continuous stream, without any pain or obstruction. Diet of mash, with enemas, continued.

29th.—The wound looking healthy, and the quantity of urine voided through it is less than it was; and no unfavourable symptom has made its appearance since the operation. Diet, &c. as before. The faecal matter is soft.

30th.—The suppurative process has been set up in the wound; let it be dressed with the turpentine liniment. A little corn may

be allowed with the mashes. The animal's general health is apparently good.

Oct. 2d.—The pus emitted is perfectly laudable, the urine now passes by the natural channel, and the animal is lively. Pulse 32, and the appetite good. Dress the wound as before ordered.

6th.—The wound is healing favourably. The animal continues lively, and feeds well on allowed diet. Give nitrate of potas. ζss in his water. Diet as before.

8th.—Repeat the exhibition of the nitre every other day. After the animal has voided his urine, which he does freely, he remains for some minutes in a fixed position, as if some little irritation existed in the bladder. Not the slightest constitutional derangement appears to be present.

12th.—The wound has perfectly healed, and the animal is apparently in good health. Diet may be plain, with occasionally a mash to keep the fæcal matter soft.

29th.—Discharged, well.

3.—CASE OF CALCULUS IN THE BLADDER.

By Professor SPOONER.

Removed by Lithotrixy.

THE symptoms, when the horse was admitted, Dec. 22, 1839, were these: The urine is voided in small quantities, and with some difficulty; very high-coloured, and viscid; and particularly is this the case after exercise, when it appears to be sanguineous. There is also present some febrile excitement, the pulse being accelerated and the mucous lining of the nostrils and eyelids injected. The altered state of the urinary secretion has been observed for some time past, but latterly the animal has expressed more pain while voiding it. Restrict the diet to mashes, and give aloes ζiv in ball.

Dec. 23d.—The bowels are responding freely to the aloes.

24th.—The urine is voided more frequently than is natural, and is also of a higher colour, but there is less pain accompanying the act. The febrile excitement is abating, the mucous tissues are regaining their healthy appearance, and the pulse has fallen to the natural standard; the animal also feeds well on the allowed diet. This may consist of bruised corn, with mashes.

26th.—Some of the urine having been collected, and allowed to stand in a glass vessel, it was observed to deposit a quantity of earthy matter, and by the ordinary tests to contain much albumen. Upon an examination of the bladder per rectum, the existence of a calculus was detected; and Professor Sewell having in remem-

brance the last case on which he operated, which unexpectedly proved to be one of lithotrity, or crushing of the stone, and considering that the friable nature of the calculus in that instance probably arose from Mr. Beeson, V.S., having, for some time previously, exhibited the hydrochloric acid, deemed the present case a fair one to test the power of lithontriptics over calcular concretions. Two drachms of the hydrochloric acid were therefore directed to be given in a pint of water daily, the diet being ordinary.

Jan. 1st, 1840.—A change is perceptible in the character of the urine. It has become light-coloured and opalescent from the diffusion of sabulous matter through it, which is deposited in very large quantities after the urine has stood for some time; it, however, still possesses viscosity, and retains its alkalinity, effervescing with acids, becoming translucent, and restoring the blue colour of acidulated litmus paper.

The calcareous deposit consists principally of the earthy carbonates.

From this it was inferred that a disintegration of the calculus was taking place, and the acid therefore was directed to be given as before ordered, particularly as the animal's general health was apparently good.

Jan. 7th.—The quantity of earthy matter deposited is not so great; the urine is passed without pain, and is pale-coloured; but it becomes sanguineous by exercise, and retains its viscosity and alkaline character.

Jan. 14th.—Since the last report but little change is perceptible. Give the draught twice in the day, morning and evening.

Jan. 28th.—The mouth has become sore from the action of the acid. The urine presents no other appearance than it has done for some time past, being pale-coloured and opaque while the animal is at rest, but after exercise assuming a much darker tint. It does not indicate the presence of any acid. The deposit from it, although still considerable, is not so large as when the hydrochloric acid was first exhibited.

Upon examination it was thought that the calculus had become much rougher on its surface. Let the draught be discontinued, and give a laxative ball, limiting the diet to mashes.

Feb. 3d.—The soreness of the mouth has disappeared. In other respects, the symptoms are as last reported. The consent of the owner not having been obtained to perform an operation for the removal of the stone, and being willing to part with the horse, Professor Sewell purchased it, so that the opportunity of seeing the operation performed might not be lost to the pupils. The animal was therefore placed on a low diet, and occasionally a dose of purgative medicine was administered.

Feb. 17th.—Professor Spooner was requested to perform the

operation. Before casting the animal, he gave a succinct history of the case, and the mode of treatment which had been adopted. It was at one time anticipated, he said, that this would have superseded the necessity of having recourse to an operation, from its appearing that the calculus was undergoing solution by the lithontriptic employed; but of late the action of the agent had not been so marked. Probably the outer surface of the concretion being less closely aggregated than its central portion, had yielded, and this would account for the asperities which could plainly be felt. A fair trial, he thought, had been given to the acid, and he believed that we should yet find that some good has been effected by it. His first object would be to try to extract the calculus entire; but should it prove too large—which he apprehended would be the case—it must be crushed, and withdrawn piecemeal.

He strongly objected to cutting through the neck of the bladder, if it could by any means be avoided, considering that such was the structure of the membranous portion of the urethra that all might be effected without it, while incontinence of urine was very likely to supervene on the bladder being thus wounded.

Mr. Spooner then pointed out on dried preparations the arrangements of the bloodvessels of the parts, noticing the deviations which now and then occur, commenting on the consequences, and how these were to be met; thus shewing how necessary a knowledge of anatomy is to the veterinary surgeon, and without it how frequently he would be unable to relieve the sufferings of those animals that are placed under his care.

The horse being cast by the aid of hobbles, a collar rope was placed around his neck, so that, when down and turned upon his back, the ends of the rope could be passed through the rings of the hind hobbles and thence brought forward through the rings of the collar, by which means the hind legs were drawn towards the fore quarters, and firmly secured. Thus the parts to be operated upon were freely exposed. The assistant now passed a whalebone staff up the urethra as far as the perineum; which when felt by Mr. Spooner was immediately cut down upon with a small pocket scalpel, making an incision so as to admit of the introduction of the index finger of the left hand into the pelvic portion of the urethra. Using this as a director, with a probe-pointed bistoury he laid open the canal to the extent of two or three inches, in a direct line with the rectum. The lithotomy forceps were at once passed into the bladder, and, by the aid of the right hand in the rectum, the calculus was readily grasped. On attempting its withdrawal, the anticipations of Mr. Spooner were realized: it proved too large to be extracted whole. He therefore was necessitated to exert considerable mechanical force so as to destroy the integrity of the stone, in doing which the body of the calculus several times escaped from the forceps, producing many

fragments which were easily extracted. The stone being still too large, and very hard, the crusher used by the human practitioner was tried, but its arms could not be extended so as to embrace the concretion. The forceps were therefore again had recourse to, and portions of the stone broken off from its edges, until it was reduced sufficiently small, when, being once more firmly seized, on the exertion of moderate force it was withdrawn.

The bladder was injected with tepid water, and, by means of Read's syringe, a continuous stream was kept up for some minutes, during which process the small particles of the calculus which remained were washed away by the return of the water. On the hand being passed up the rectum, and the two sides of the bladder brought in apposition by pressure, this viscus could be felt free from any calcareous deposit. The edges of the wound were now drawn together by two interrupted sutures, and the animal liberated.

Owing to the many fragments into which the calculus had been broken, the time occupied in the operation was much protracted. It extended to thirty-three minutes; but the animal seemed to suffer comparatively little during it.

As soon as liberated he was removed to a spacious loose box, and on examination of the pulse it was found to be 86. Quietude was enjoined, and he was made comfortable; the body being clothed, the legs bandaged, &c. and a warm mash placed before him.

One hour after the operation the pulse had fallen to 48 beats in the minute, and its tone was somewhat full, while occasional efforts to void urine were made, and the respiration was a little hurried.

Six hours afterwards the pulse had risen to 54, and was irritable. The animal, however, had eaten his mash, and appeared lively; nevertheless, to guard against any unpleasant consequences, and to prevent the access of inflammatory action, blood was abstracted from the jugular vein to the amount of 8lb, and aloes ζ v administered in the form of ball. The animal was then left for the night, directions being given that, from time to time, the groom in attendance should see that no accident occurred.

Feb. 18th.—During the night the animal has lain down frequently, manifesting slight uneasiness. By rubbing the neck, the pin became dislodged, and a little blood escaped; the orifice was, however, again quickly closed by the attendant. A small quantity of blood has also flowed from the wound in the perineum, but it cannot have exceeded two or three ounces.

This morning the animal was seen to urinate. The penis was drawn, no pain was experienced, and the secretion flowed by the natural channel, not a drop escaping by the wound. In quantity it was about half a pint, of a pale colour, and affording no deposit. The pulse has become more quickened, being 96, and its tone irritable; the tongue is also coated, but the mucous tissues are not

injected, and the respiration is tranquil. No swelling about the perineum has taken place, and the animal is lively.

It having been thought that the sutures created some irritation, they were removed, and the parts lightly fomented with tepid water. As the bowels had not been acted upon by the aloes, an enema was directed to be thrown up, and repeated if found necessary. A desire for food being evinced, mashes were allowed.

19th.—In the afternoon of yesterday the pulse had fallen to 56, and the bowels were responding freely to the aloes. This morning the pulse is a little more accelerated, being 60, its tone feeble: the animal, however, has fed well on mashes, and is lively; the tongue is not so much furred, and the breathing continues natural. He has been observed to pass his urine in larger quantities, and by the natural conduit. No swelling has taken place around the wound, but a thin sanies is emitted from it. The bowels continue in a relaxed state. Let the diet continue the same, and keep the parts clean.

Feb. 20th.—Pulse 56, tone improved. The suppurative inflammation has been set up in the wound, pus being mixed with the serous secretion. It has a favourable appearance, and no swelling around it has taken place. The animal continues lively, and his appetite is still good. The urine is passed freely, and it is both natural in quantity and quality. The faeces are pulraceous. Allowed sliced carrots with mashes. Keep the parts clean, as before ordered.

21st.—The pulse is 50, and its tone continues to improve. This increase of the heart's action appears, in a great measure, to be dependent upon the nervousness of the animal. When approached he trembles, as if fearful that something was about to be done to him. The respiration remains unaffected, the mucous tissues retain their healthy tint, the tongue has become clean, the appetite continues good, the animal lively, and the alvine evacuations soft from the diet. He urinates freely, and lies down during the night. The wound retains its favourable appearance, and the pus discharged from it has increased in quantity, and is laudable. Treatment as before ordered.

22d.—Pulse 45, its tone becoming natural, and otherwise no unfavourable symptom remains present. The wound suppurates freely, the animal is lively, the excretions natural, and his general health apparently good.

It is now the fifth day since the operation, and no urgent symptom has shewn itself. The little constitutional disturbance which at first was observed might have been anticipated; a successful issue may therefore be confidently hoped for. The diet may now consist of bruised corn with mashes and carrots, and let the wound be kept clean.

24th.—It is seven days since the operation was performed, and no doubt now exists as to the favourable termination of the case.

THE CALCULUS was of an ovoid form, flattened, and its surface much roughened. It weighed $4\frac{3}{4}$ ounces troy. A fragment subjected to the influence of heat by means of the blow-pipe first became black and then whitened. In hydrochloric acid it underwent solution with effervescence. By boiling in caustic potassa it yielded no ammonia, neither did nitric acid afford any trace of uric acid.

Twenty-five grains, exposed for some time to a white heat in a Wedgwood ware capsule, by which the animal matter was consumed and the carbonic acid dissipated, left thirteen grains of an alkaline earthy residuum. This dissolved in hydrochloric acid without any effervescence, proving that the carbonic acid had been disengaged by the heat. The solution being filtered, it was divided into two equal portions.

To one portion, water of ammonia was added to neutralization, and to this a solution of the phosphate of soda and ammonia, which, on being heated, threw down a precipitate of the ammoniaco-magnesian phosphate, amounting to 1.5 grains. This being separated by means of a filter, on the addition of oxalate of ammonia to the remaining solution, an abundant precipitate of the oxalate of lime was obtained, amounting to nearly fourteen grains : actually 13.77 grains.

To the other portion a solution of the acetate of lead was added, for the purpose of detecting phosphoric acid ; but no turbescence whatever took place, consequently there is an absence of this acid and of the earthy phosphates.

Fearing that some error might have taken place, another mode of analysis was adopted. A few grains of the calculus were deprived of almost all the animal matter by the aid of the blow-pipe, and the earthy residue dissolved in dilute hydrochloric acid, when a considerable disengagement of carbonic acid gas took place. The solution being filtered, water of ammonia was added to it, when a slight cloudiness ensued, arising from the presence of very minute flocculi ; but no gelatinization, as is seen when the earthy phosphates are present, constituting the bone-earth calculus.

The inference deducible from these analyses, in which I have been kindly assisted by Mr. Hughes, is, that the composition of the calculus is carbonate of lime and magnesia, with animal matter ; or, to give the proportions in one hundred parts,

Animal matter	11.55
Carbonate of lime	86.12
Carbonate of magnesia	2.33

100

The questions which now almost naturally suggest themselves are these :—The friable nature of the concretion having been as-

certained—and, in all the calculi which I have examined, carbonate of lime forming the largest constituent—cannot some mechanical means be employed by which such an accumulation may, at all times, be with certainty crushed?

Had the hydrochloric acid any action upon the calculus? Its composition being shewn, it admits of no doubt but that out of the body it is almost a perfect solvent for it. Would not some other means of introduction be thus pointed out? What objection can there be to the injection of this agent, in a dilute state, into the bladder?—but more will be said in reference to this hereafter.

Sometimes it is the case that a calculus escapes from the bladder, and finds its way into the urethra, where, becoming impacted, it creates much pain and irritation, and occasionally it blocks up the passage, thus causing an over-distention of the bladder, of which this is a splendid specimen. [See fig. 5, plate IV.] This calculus differs from almost all others that I have seen, the form of these being a flattened oval, while this is angular, its outer surface smooth, and apparently it is made up of laminæ. If it really be so, this would constitute a *fourth* kind or variety of calculi; but I cannot speak positively on this head, from no section of the concretion having been made.

Instances have been known of the bladder having been thus burst. The following cases, extracted from the French, are in proof of this position.

“A seven-year-old cavalry horse was brought to us, which had suffered severely for more than three days from retention of urine. On examining him, I found that the bladder was immoderately full, and that the urethra was obstructed by a round hard substance, which was situated about three inches from its aperture. Finding it impossible to extract this substance in the usual manner, we cut through the urethra down upon this body, and, by that means, extracted a yellow calculus weighing a hundred grains, the surface of which was very irregular. This being removed, the horse became free from pain; the difficulty of urine was removed, and, ten days after the operation, the wound was perfectly closed.

“A truck dog died in consequence of the bladder being distended with calculi to such a degree that it burst, and the urine infiltrated even to the skin.

“An extraordinarily large bladder was brought to us as a curiosity by a farmer, who stated that he had found it in an ox which he killed because it would not eat. This distention of the bladder appeared to us to be produced by retention of urine; we therefore requested permission to examine the urethra, and we found in it a very large stone.”

When a calculus is known to exist in the urethra, it may be re-

moved by mechanical or other means very easily; hence the necessity of a careful examination of the parts; for an ignorant pretender, when he perceived that there was something wrong in the urinary organs—as he commonly expresses himself—might give his diuretic agents to overcome it, and thus be adding fuel to the fire. The following case is admirably illustrative:—

CASE OF CALCULUS IN THE URETHRA.

By PROFESSOR SPOONER.

“The horse was the property of Sir Robert Peel, Bart. When my attention was directed to him, I perceived that he was standing with his hind legs stretched out, making frequent and painful efforts to void his urine, and the penis was pendulous. My first object was to ascertain the history of the case, and I was informed by the coachman, that on the preceding Sunday he had been worked in the carriage, and had gone part of the way to Windsor. At the end of his journey, when taken out of harness, he was first observed to have some difficulty in voiding his urine, which escaped from him in very small quantities only. He was then sent up to town, and placed under the care of a practitioner, under whom he remained until the following Sunday, when, he was admitted into this Infirmary. I am assured by the coachman, that during this period, although straining perhaps six, seven, or eight times within the hour, the animal had never voided more than a tea-cup full of urine at one time; evidently shewing that there was an impediment to the free escape of this fluid. I do not know what treatment was adopted, except that enemata were administered, and I presume such medicines given as the case appeared to require; and there are marks of certain external applications, as counter-irritants, having been had recourse to. I am not desirous by these observations to condemn the treatment adopted prior to admission; because, although it was quite evident, from the statement of the coachman, that there was in the first instance an impediment to the free passage of the urine, yet there is no evidence whatever to show that the calculus then existed where it did when the animal was brought to the College.

“Having heard the history of the case, and observed the symptoms that were present, I considered it my first duty to explore the bladder.

“In passing my hand up the rectum, I found that I had some difficulty in doing it; not from any contraction of the sphincter muscle, but from the constricted state of the rectum consequent on the pressure imparted to it from the over-distended bladder.

“After relieving the rectum of its contents, which were very hard, and had evidently been retained there for some time, I was enabled

to pass my hand forwards and get at the fundus of the bladder; but it was with extreme difficulty that I could reach it.

"Having found the bladder in the state described, of course I was unable to make any further investigations as to whether the impediment to the animal's voiding his urine arose from some foreign body being in the bladder or not, since we cannot ascertain the existence of a calculus in this viscus unless it be in a flaccid state.

"On withdrawing my hand from the rectum, I observed that the perineum was remarkably distended. I placed my fingers on it, and it appeared to me to be distended with a fluid. This led me to infer, that the obstruction existed in the urethra rather than the neck of the bladder.

"I now proceeded to examine the pendulous penis. Feeling it with my hand, I at once discovered the existence of a calculus. It was situated about two inches up the urethra. By fomenting the penis, and giving gentle pressure, I forced it down a little way; but it was evident that I could not thus pass it out of the penis in an entire state.

"By elevating the penis, I could distinctly see the calculus; but in order to get it out whole, I should have been obliged to have cut down upon it through the urethra. There would have been no particular objection to this method; but I considered that it would be more advisable to endeavour to break the calculus than to perform this operation; I, therefore, introduced a pair of obtusely-pointed forceps, with which I embraced the concretion; and, after making one or two ineffectual attempts to withdraw it entire, I exerted force and crushed it, and thus was able to remove it in the state you now see it. I should say that, before broken, it was about the size of a walnut. Several fragments of it passed out, and were lost in the stream of urine that immediately followed the crushing of the stone, which urine had been confined in the urethral canal.

"After I had thoroughly cleared the extremity of the urethra of all calcareous matter, my next object was to ascertain the state of the urethra in its course towards the bladder. In order to do this, I introduced the flexible catheter. It readily passed into the bladder; but the urine not escaping by it, I withdrew it, and passed it a second time; the urine now flowed through it, but only in a very small stream, and slowly.

"By emptying the bladder, I wished to ascertain if any portion of the calculus remained in the urethra. I, therefore, introduced my hand into the rectum, and gave gentle pressure to the bladder. Having so done, I allowed the animal to stand quietly for a few minutes. He then stretched himself out, and by violently contracting the abdominal muscles, caused the urine to be voided in a full stream. I could hardly have supposed that such a quantity

could have passed through the urethral opening. The bladder was thus, as it were, emptied mechanically by pressure imparted to its walls consequent on the violent action of the abdominal muscles; for it had been in such a state of distention that it had lost all power of contraction. The animal was evidently much relieved by the act. I stayed with him about half an hour after this, when he placed himself in a position to void his urine again. He did so; and passed about a quart. The urine voided almost immediately after the extraction of the calculus, and which came out in such a quantity and with the force I have spoken of, was dark-coloured, and contained much mucus; but this was as limpid and colourless as water. This difference arose from the urine that was first voided being retained a long time in the bladder; but that which followed half an hour afterwards must either have passed down from the ureters, or have been secreted by the kidneys subsequently. The animal was now placed in a loose box, an enema thrown up, and solution of aloes $\mathfrak{z}\text{vj}$, with tincture of opium $\mathfrak{z}\text{ss}$, given in the form of draught; the diet being restricted to mashes. The pulse prior to the operation was 60 in the minute, full and throbbing; and two hours after it had settled down to 36 beats in a minute. I now left my patient without any apprehension, enjoining perfect quietude. On Monday morning I found him feeding, and otherwise apparently doing well. No symptoms of pain were evinced; he voided his urine freely, but not in those quantities that a healthy horse usually does. On Tuesday he was allowed walking exercise, and he was then observed to void his urine once or twice during the exercise, which was attended with no pain, nor any straining after the bladder was emptied. In the evening he was again exercised, when he again voided his urine with perfect ease. I saw him immediately after this last exercise, and I perceived symptoms of uneasiness. I watched him for some time. The uneasiness he evinced was not referrible to any retention of urine, for there were no efforts to urinate; but he occasionally looked round to his side, then lifted up one fore leg, as it were by a nervous twitch, keeping it so for a short time, then putting it down, and changing it for the opposite leg. This was followed by an occasional violent stamp with one of the hind feet, and a remarkable twitching of the tail, which is a characteristic symptom whenever any affection of the urinary organs exists. The nose was rested upon the manger, against which he would now and then rub it. As yet the bowels had not responded to the medicine. The rectum had been emptied, as before said, and enemata thrown up; but these did not appear to have caused any action. I examined the state of the bladder and found it empty. I could readily cause its walls to come in contact with each other, and was thus enabled thoroughly to explore that viscus, and to ascertain that no calculus existed within it. What, then, was the cause of

this subsequent irritation? Some might have thought that it arose from a small calculus passing from the kidneys down the ureters into the bladder, since this is attended with great pain; but I bore in mind the fact of the bowels not being acted upon, and that of the rectum being filled with hardened feces. I, therefore, thought it advisable to give him a more powerful cathartic, and administered seven drachms of powdered aloes, with a drachm of calomel, made into a soft ball; the enemata were directed to be continued, and in two or three hours the urgent symptoms passed off. On the following morning he was free from pain, and during the early part of the day the bowels responded freely to the medicine. He continued in the infirmary until yesterday, when he was discharged, apparently in a state of perfect health.

"I should have informed you, that the calculus has been analyzed by Mr. Morton, and it consists principally of carbonate of lime, with animal matter,—the usual constituents of these concretions."

From the high degree of irritation excited in the bladder by a foreign body existing there, although its increase in size has been gradual, much thickening of the mucous coat takes place, and frequently false membranes are formed in which the stone may become lodged. These specimens from the museum shew to what extent disorganization of the coats of the bladder may proceed [see fig. 5, 6, 7, Plate IV]. And the following case by Mr. Purves, of the Hon. East India Company's Service, is, I think, in proof of the second part of this position. I give the case in his own words.

"*Disease*.—Stone in the bladder. Admitted for operation October 16th, 1839.

"*Symptoms*.—Pain when voiding his urine, which he often does; irritation, and frequent emissions of semen. On account of this last circumstance he has been sent into the hospital, as it makes the other troop horses unsteady. These symptoms have been present in a greater or less degree for three years, but lately they have become more urgent.

"On examination per rectum, a large mass was felt within the bladder, which gave to the hand more the sensation arising from the pressure of a tumour than a calculus: from its size I fear it will not be possible to remove it. The operation, however, being determined on, the animal was cast, and a cane staff being passed up the urethra, it was cut down upon; and through the opening made in the perineum a sound was introduced into the bladder, when it was distinctly heard to strike against a solid body. The forceps now being made use of, I found it impossible to extract the stone, on account of its size and *adherence to the coats of the bladder*. The opening in the perineum was enlarged, the urethra dilated, and, although assisted by Dr. Ross, we could not get the forceps

to lay hold of the calculus. The animal and ourselves becoming exhausted, we gave over making any further attempts until we were provided with other and better instruments.

"On the morning of the following day the Sycee reported that he found the stone, which weighed ten ounces three drachms, in the stall. The animal appeared in great pain during the night, and was frequently lying down and getting up again. Some swelling around the incision supervened; but the wound gradually assumed a healthy appearance, the urine again flowed through its natural channel, and by the 15th of November the animal was apparently well in every respect."

Here is a preparation, also from the museum, which it is quite possible, by the sound merely, might have been mistaken for a calculus. It consists of a large pedunculated tumour adherent to the coats of the bladder, probably of the nature of a polypus; and its removal by any degree of force may have been attended with unpleasant consequences. [See fig. 7, plate IV:]

The indications of the presence of cystic and urethral calculi, with the course of procedure necessary to be adopted, will have been gathered from the preceding cases; but the last named is a division on which I confess I feel an inclination to expatiate a little.

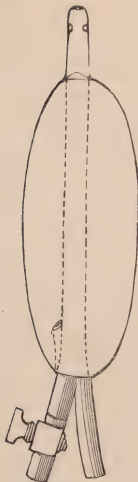
The means by which a calculus may be removed from the bladder may be classed under four heads:—

1. LITHOTOMY.—This consists in making an incision about the neck or cervix of the bladder sufficiently large to remove the stone entire. It is an operation which certainly enables a veterinary surgeon to shew his skill and dexterity; but *except in extreme cases*, I concur, with Professor Spooner, that it should not be had recourse to in the horse.

2. LITHOTRITY.—By this means the stone is broken down within the bladder, and removed piecemeal through the urethra. The objection advanced against this plan is, that often a fragment of the calculus will remain behind, and become the nucleus for another. This tendency to calcareous deposit is, however, extremely difficult and at times altogether impossible to obviate or counteract, and thus another calculus will form without the aid of this accidental nucleus.

3. LITHECTASY OR CYSTECTASY.—This consists in gradually dilating the urethra and neck of the bladder, and then withdrawing the stone entire.

This last is the operation which I humbly conceive would be found available in most, if not all, the cases that fall under the notice of the veterinary surgeon. I regret that the nature of my avocation precludes me from adducing any experiments or practical facts that bear me out in this opinion. Of course, it simply con-



sists in cutting down upon the perineum of the horse, a whalebone staff having been previously passed up the penis, and then introducing a dilator. One on the principle of Dr. Arnott's fluid-pressure dilator might be used, and such easily made by surrounding a straight catheter with a cylindrical bag, consisting of silk or cotton rendered impervious to water by means of caoutchouc, having a stop-cock affixed. The catheter with its investing bag being passed up the urethral canal into the bladder, the cylinder is to be gradually filled with water or air by means of a syringe, and, when distended, allowed to remain in until the membranous portion of the urethra is sufficiently dilated so as to admit of the free passage of the stone, which, of course, is to be extracted by means of a pair of forceps. Mr. Arnold, instrument maker, Smithfield, at my suggestion, has formed a dilator of this kind, of which the subjoined woodcut will convey an idea. In the mare the operation is still more simple.

The tube, having the stop-cock affixed, is for the purpose of filling the water-proof bag, which in cases of emergency may consist of a small bladder; and, through the other, fluids may be thrown into the bladder itself.

The dilator is shewn distended. The only objection that I can see to this plan, is the fact, that frequently some time must elapse before a sufficient degree of dilatation of the urethra can be obtained. But if this should fail, by some other mechanical contrivance, such as a large three-branched speculum, the urethra may be distended; and this being effected gradually, no rupture need be apprehended; and while the instrument still remains in, the forceps can be introduced and the stone extracted. Here, however, I am merely offering suggestions, which may, after all, prove nothing worth.

Mr. Mogford, of Guernsey, is of opinion that this dilatation of the urethra is altogether uncalled for; and he maintains that it is quite practicable, without even the aid of forceps, to remove a calculus from the bladder. For this purpose he passes one hand up

the rectum (having previously laid open the urethra, at the perineum, if a horse), and then introduces two fingers of the other hand into the bladder, with which he directs the stone towards the neck of that viscus, and through it into the urethral canal. In this way, he informs me, he has succeeded in taking out two calculi from the bladders of horses, one of which weighed four ounces and a half. Soon after the performance of the last operation by Mr. Spooner, Mr. Mogford was at the College, and at that time we were desirous of having a pair of forceps made, both large and strong enough to crush or break down the stone within the bladder. He at once expressed his conviction that such an instrument was uncalled for, and then related his mode of procedure. Subsequently he forwarded to me the following communication corroborative of his views.

Guernsey, July 10, 1841.

Dear Sir,—WHEN I was last in London, and at the Veterinary College, you were very intent on the invention of a pair of forceps for the extraction of calculi from the bladder of the horse. I then expressed my opinion that no such thing was necessary, as I had more than once extracted a stone from the bladder with my fingers alone. On my return home I took the first opportunity which offered itself at the knacker's yard of putting the question beyond doubt. In a mare that was about to be killed, I, without twitching or casting her, a man simply holding her with a halter (determining thus to ascertain whether it could be done without wounding the urethra), introduced an egg into the bladder, and extracted it again with the fingers alone; my right hand being placed in the rectum, and the two fore-fingers of the left hand in the bladder. But as I had no witness to corroborate the fact, I introduced the egg again into the bladder, and requested that the mare might not be killed until the following morning, when three medical gentlemen, Messrs. O'Brien, Magrath, and Lucas, attended with me, and in their presence I extracted the egg in the space of one minute. In consequence of the egg having been left in the bladder, the mare had retained her urine, and the bladder was very full, and, having no catheter near, I was obliged to have recourse to the nozzle of a pair of bellows, with which I drew off the urine, and which, of course, retarded and lengthened the operation; but the day previously, when the bladder was empty, it was performed in the space of a quarter of a minute. Some one present asked the question, Was the egg in the bladder? To put that beyond dispute, I again introduced the egg into the bladder; the mare was then killed, and the bladder taken out with the egg in it. The urine had acted considerably on the shell of the egg, but still it was entire.

I am, your's respectfully,

WM. MOGFORD.

[When this paper was read, I regretted my inability to adduce a case shewing the advantages to be derived from LITHECTASY. The following, however, has occurred since, and I need hardly state that to be enabled to introduce it is extremely gratifying to me.

Perhaps I may be permitted, in addition to what has already been advanced in reference to the operation, to say, that should there exist spasm of the neck of the bladder, or a constriction of the urethra, it may be overcome by applying the extract of belladonna along the perineum.]

• A CASE OF CALCULUS IN THE BLADDER OF A MARE.

By Mr. J. B. SIMONDS.

Removed by Crushing and Lithectasy.

On the 17th of January I was called to a case in the country, of a mare stated to have a calculus in the bladder. The account given to me was, that she had laboured under incontinence of urine for the last twelve months, and during the greater part of that period had been under the treatment of a farrier. The symptoms not being relieved, the owner became impatient, and consulted Mr. Wright, veterinary surgeon, of Trimley, who, being of opinion that there must be some abnormal condition of the bladder, very properly made an examination by passing his hand up the vagina. He at once detected the existence of a large calculus in the bladder, and on communicating the fact to the owner, it was decided that the animal should be operated upon, and I was requested to perform the operation.

I found the patient to be a very valuable brood cart mare, eight years old, and in excellent condition, the only indication of ill health being incontinence of urine, in consequence of which the inner parts of the thighs and legs were excoriated by the constant flowing down of the urinary secretion. My first object was to ascertain the size of the calculus, and, if it were possible, to extract it whole through the meatus urinarius, because had I been obliged to make a section through the meatus, in order to remove the stone, the probability is, that subsequently there would have been permanent incontinence of urine; for there is greater danger to be apprehended of this following the division of the meatus urinarius in the female than from making a section through the membranous portion of the urethra in the male. I was also desirous of performing the operation standing, as I felt satisfied that I should have greater command over the parts than if the mare was cast and placed on her back, as in lithotomy and lithotripsy in the horse. For the purpose of making such examina-

tion, and proceeding with the operation if I found it practicable, I had a twitch placed on the nose, and secured the near hind leg with a side line. I found that the calculus filled up the whole of the interior of the bladder, from this organ being firmly contracted upon it. It was also evident that the bladder had long been in a state of disease, as it was much thickened in its coats. No sound was necessary to detect the calculus, for it could be readily felt through the parietes of the vaginal cavity, and the finger being passed into the meatus proved that it had a rough surface, while it was so large as to forbid any hope of its being extracted whole. In order to ascertain whether the calculus could be moved in its situation, and be more readily grasped with the forceps, I passed a catheter into the bladder, through which water was pumped, so as to distend that viscus to a certain extent: such, however, was the irritable state of its mucous lining, that the fluid was instantly rejected: an ounce of it could not be retained, although I made pressure on the neck of the organ to prevent its escape. Finding that there was no chance of doing good by these means, I determined on dilating the meatus, crushing the calculus, and extracting it piecemeal. For this purpose, I first had recourse to the speculum vaginae exhibited to you a few evenings since. I could very readily pass my fingers into the meatus, but the speculum was not sufficiently large to enable me to obtain the dilatation I required. However, being provided with an instrument invented by Mr. Morton, and which may be called an hydrostatic dilator, my object was soon accomplished; and had I not been furnished with this instrument I certainly could not so successfully have performed the operation. It is, as you see, a common metallic canula, such as is used to draw urine from the bladder, but made somewhat larger at the end, so as to allow of the attachment of the side branch of the enema syringe. Over this is fixed a Mackintosh bag, eight inches in length, and the same in circumference, supplied with a stop-cock, which also fits the pump. Being passed into the urethra in a flaccid state, your assistant connects the side branch, and, the pump being put in action, you are enabled to fill the bag either with air or water, and, consequently, to dilate the urethra to the full size of the bag [see *fig.*, p. 42.] Having succeeded in doing this, I was enabled to retain it in for five minutes, and by that time I had a beautiful dilatation of the urethra, and could easily withdraw the instrument without letting out the fluid. After having used the dilator so successfully, the crushing instrument, in a closed state, was readily passed into the bladder, and the blades being opened, by introducing my hand into the vagina, I manipulated the calculus into the teeth-like projection of the crusher. Having taken firm hold of the calculus, pressure on the instrument was made with my chest, which force proved sufficient to break down the stone into pieces, as here presented to you.

There was now little or no difficulty experienced in extracting the broken calculus by the introduction of the fingers through the meatus urinarius. I could readily pass in three fingers and a thumb, and take out portion after portion. After I had removed a large quantity, I found that there yet remained a considerable mass in the bladder, which on further examination proved to be a membrane. My first impression was, that in consequence of the long-existing inflammation of the organ, a false membrane had been thrown out, and that it was organized by the vessels of the mucous lining of the bladder. I reflected, that if this was an organized false membrane, and if, in order to remove the remaining pieces of the stone, I made great traction upon it, the probability was, that I should tear through the coats of the bladder. I was, therefore, placed in a difficulty; but finding that I could bring some portion of it through the meatus, and that many pieces of calcareous matter were adhering to it, I resolved upon exercising sufficient force to draw it into the vagina, and ascertain, if possible, by the aid of sight, its true character. In doing this, fortunately a portion was grasped which was of a dark colour, shewing that it was unorganized, and, therefore, that there was little danger in making a firm pull at it, the probability being, that I should thereby remove the remaining part of the calcareous matter. This was successfully done; but from its large size some resistance was offered to its passage, which produced much pain, as the mare struggled more at this part of the operation than any other. The whole being removed, the only thing necessary to complete the operation was freely to wash out the bladder with tepid water. The calculus weighed with the membrane eleven ounces and a quarter, and was removed without either casting the animal or any cutting, thus leaving the neck of the bladder in as normal a condition as possibly could be expected, its mucous coat being only slightly abraded. I did not ascertain the precise time occupied in the operation, but I should imagine that it was from twenty to twenty-five minutes. The pulse, shortly after the operation, was but little disturbed, and there were no indications of an inflammatory state of the system. From accounts which I have subsequently received, I learn that the patient is going on remarkably well.

Although I was enabled so easily to crush the calculus, still I am of opinion that, had it been more dense in its structure, the operation would not have been so successful. The instrument I employed, although a powerful one, is powerless when compared with that used in human practice. Pressure or percussion, by means of a wooden mallet, is the only force that can be applied to it, whereas the other works by means of a screw. I would, therefore, recommend you, when providing yourselves with instruments for lithotrixy, to select a crusher that acts by a screw power.

A word or two with reference to the symptoms which indicate the presence of a calculus in the bladder. Even in the human subject the symptoms are sometimes uncertain;—our ablest practitioners—men who have operated on dozens of cases—have occasionally differed in opinion as to whether there was a calculus present or not. One has thought that, by means of the metallic sound introduced into the bladder, he has heard it; and, subsequently, another operator having sounded, he could not hear it. There is, however, one symptom frequently present in the human subject which is characteristic: that is, the flow of urine is often suddenly arrested, although there may be no pain experienced by the patient even when the bladder begins to contract on the stone. This symptom frequently arises from the falling down of the calculus to the neck of the bladder; but in our patients there is an absence of this; for, the body of the horse being supported horizontally, the calculus has a tendency to fall to the fundus, and not to the neck of the bladder; it is, therefore, only when the calculus has occasioned disease in this viscus, producing great irritability, and the urine is mingled with blood, that we suspect its presence. There is, however, one symptom which strengthens our suspicion; namely, that after the bladder has been emptied of its fluid contents, the animal still keeps himself in a position to stale, and it is this which directs the attention of the parties having the charge of the animal to the existence of disease in these organs. I have stated, that a small quantity of blood being occasionally seen mixed with the urine is one of the symptoms; but this is not an infallible sign, in illustration of which I will relate two cases that have occurred in my practice. In one of them the animal had, twelve months before, been the subject of an attack of spasmodic colic. He was placed under the hands of a farrier, who gave so large a quantity of the oil of turpentine, that inflammation of the kidneys was brought on; subsequently the animal was brought under my notice, suffering from nephritis, of which he apparently recovered. Some months afterwards he was observed to void blood with his urine, and this was supposed by another practitioner to arise from a calculus in the bladder. After being placed under treatment for some time, the animal died, and, on a post-mortem examination, it was found that there was extensive ulceration in one of the kidneys, and that the blood sent there for its nutriment and secretion found its way unchanged through the ureters into the bladder.

In the other case, I was called in by the owner to see a colt which had that morning voided blood with his urine. On inquiry, I found that on the preceding night, having been turned into a pasture with other horses, he had been driven about by them. I also ascertained that he had slipped down, and that one hind leg had passed forwards and the other backwards. The con-

sequence of this was a rupture of the emulgent arteries, and hence arose the mingling of blood with the urine.

The calculus which I extracted has been analyzed by Mr. Morton, and it is found to consist of nearly one-half carbonate of lime, the remainder being animal matter. One singular circumstance connected with this case—and which increases its interest—is the fact that a great portion of the calculus was enclosed in a false membrane. Whether this membrane consists of albuminous matter, or of the fibrous portion of the blood thrown off from the coats of the bladder, I cannot say; but its existence in this detached form is extraordinary. I had the opportunity of seeing both the cases operated upon in this institution by Mr. Sewell and by Mr. Spooner; but in these the calculi were free in the bladder. A false membrane is sometimes met with in the human subject; but I do not know that it is ever found detached, being generally connected and supplied with blood from the mucous lining tissue of the bladder.

The fourth mode of removal is by SOLUTION. This may be effected in two ways; first, by the agency of medicines administered by the mouth, and, secondly, by the injection of chemical solvents into the bladder.

The composition of calcareous concretions in the horse and the ox having been given, it will be at once perceived, that only one class of LITHONTRIPTICS, or solvents for stone, is called for, these being acids. The union that binds carbonic acid and lime together is so feeble that almost the weakest acid will destroy it; hence for this purpose the acetic, the nitric, or the hydrochloric acid may be successfully employed. I should prefer the last-named, from the fact that it is the same as that met with in the alimentary canal, although I believe either of the others would prove as efficacious.

I have before observed, that the mineral acids when given do not undergo assimilation, and have adduced a proof; but I believe I have other proofs in cases that have fallen under my own notice, and which I will now proceed to record. In the second case of calculus in the bladder removed by Mr. Sewell, it is stated that it was *accidentally* an instance of lithotripsy. This arose—at least such is my opinion—from the veterinary surgeon under whose care the animal was first placed, after he had ascertained the existence of the calculus, endeavouring to cause its solution by giving dilute hydrochloric acid for some time. By this agent the integrity of the mass was destroyed, so that by the pressure of the forceps it broke into many pieces.

The second case illustrative of its influence was a patient of Mr.

Draper's, V.S. of Melbourne. He was an aged horse, and for years had been known to void much gravel mixed with his urine. The constitutional disturbance, followed by emaciation, at length became so great that the animal was altogether incapacitated for labour, and, indeed, deemed only fit to be slaughtered for the dogs. Mr. Draper, being desirous of testing the solvent properties of hydrochloric acid, gave it in two-drachm doses for a very long time, and perceiving, after only a very short period had elapsed, that it manifested decided action, he steadily continued its use, when he had the gratification of witnessing the gradual return of the health of the animal, which at length became perfect, and he was again put to work. It is quite possible that a calculus was not formed in this instance, and that it was a case of "gravel" merely; nevertheless, the influence of the acid on the calcareous matter is equally as satisfactory.

The third case will be, perhaps, considered still more conclusive: it was communicated to me by Mr. Hutton, V.S. Great Yeldham, and is recorded in the *TRANSACTIONS* for the past session. I extract it, with some observations made by me at the time.

Great Yeldham, Nov. 11, 1842.

My dear Sir,

HAVING promised you the history of a case of urinary calculus when you were lecturing upon lithontriptics during the past session, I take the present opportunity of forwarding it to you. You will perceive it corroborates the views you then advanced, for my patient was successfully treated with hydrochloric acid.

The horse in question was the property of a farmer and miller; he was about eight years old, and had laboured under a difficulty of voiding his urine for a long time previous to my attention being directed to him, and during that time, the owner informed me, the horse had had given to him three or four diuretic balls a week. He was gradually losing his condition, and, being unable to perform his work, was sent to me to examine and give an opinion.

Upon ascertaining the history of the case and observing the symptoms, I at once suspected there was a calculus in the bladder. Upon examination per rectum, I found the bladder was not sufficiently flaccid; I therefore introduced the flexible catheter, and by that means emptied the bladder of a part of its contents, which act was attended with difficulty, the escape of the urine being obstructed by sabulous matter. Upon now examining the bladder the second time, I detected the existence of two calculi in that viscus. I at once proposed to perform the operation of lithotomy, and gave a dose of physic to prepare the animal for the operation, promising the servant that I would call and see his master the following day, which I did. Having informed him the nature of the case, and telling him what must be done, being a very humane man,

he dreaded the idea of an operation, and said he would not have the horse put to any misery by cutting him about, and would rather let him die as he was. Not being able to prevail upon him to let me operate, I at once determined upon trying the effects of hydrochloric acid, well remembering what you said respecting it when lecturing upon lithontriptics. The diet was restricted to bran mashes, &c. and I commenced by giving him $\mathfrak{z}\text{ij}$ of the acid in three gallons of water twice a day. After a little difficulty he drank it freely. This was continued for a fortnight, when I found but very little improvement. I then gave aloes $\mathfrak{z}\text{vj}$, and discontinued the acid for three days. I then increased the dose to $\mathfrak{z}\text{vj}$, in three gallons of water three times a day, which the horse drank freely after five or six days. I now found that the acid had its desired effect, for there was a great quantity of calcareous matter voided with the urine, and the appetite also began to improve. This treatment was continued for four months, giving a dose of aloes occasionally, and the horse is now in good health and condition, and stands his work well.

I forward with this several pieces of the calculus, having many more of the same magnitude, which were picked up from the ground after the horse had voided his urine (*see fig. 3, plate III*).

I remain, your's truly,

To Mr. Morton, &c. &c.

R. R. HUTTON.

This case is interesting, because it shews the influence of certain solvents upon concretions deposited in the urinary bladder, and which have been conveyed to that viscus through the medium of the blood.

It is interesting also on another account; namely, the largeness of the fragments voided. Their peculiar form would incline me to say that a calculus had been formed, and although, perhaps, it had not attained to any very great degree of hardness, yet the integrity of the mass was destroyed by the agent administered. I have never before seen such large portions passed through the natural channel, the urethra.

I would, however, observe, that Mr. Hutton informed me they were softer when voided than they are now, and their escape was accompanied with pain, at which we are not at all surprised; also that the quantity of sabulous matter mixed with them was very considerable.

The hydrochloric acid, in my opinion, had a twofold action. Not only did it effect the destruction of the cohesion of the particles of the calculus or calculi formed (for Mr. H. thinks there were two), but it also prevented the deposition of more calcareous matter from the urine, which, when in an abnormal state in the horse, often throws down a large quantity of the earthy carbonates. And this shews how

necessary it is that the digestive apparatus should be attended to; for although by chemical solvents we are enabled to get rid of the calculus, yet we must attend to the general health and condition of our patient, or a fresh one will form. It is true that the formation of a renal or vesicular calculus depends upon chemical laws: a peculiar morbid state of the urine has induced it, and the materials are there of which the mass is made up. But we must ascend a step higher in our investigation, and ask, What has given rise to this morbid disposition? This alone will enable us effectually to combat the disease. You will hear some aver it is the character of the water which is the cause of calculous accumulations, and others as boldly state it to be the food; and there can be no doubt but that the digestive organs materially influence their formation, whether in the kidneys or intestines. There have been many objectors to the use of solvents of calculi, whether acid or alkaline. Dr. Prout, in his admirable treatise on the "Stomach and Urinary Diseases," after stating that he fears but little good can be hoped to be obtained from them, from the *unnatural condition* induced in the urine by them, goes on to observe, that, when any of these solvent agents are introduced into the bladder through the system, the vital powers may exert themselves, and thus neutralize or destroy their action. But when directly injected into the urinary vesicle, he has found decided benefit follow the use of a weak acid, it tending both to dissolve the calcareous mass, and to allay the irritation which is invariably present in the mucous lining of the bladder.

I have analyzed a portion of these fragments, and find it to consist of carbonate of lime with mucus: and whenever there is a calculus in the urinary passages, or even a tendency to its formation, this increased secretion of mucus from the bladder is sure to take place, and it always constitutes a large portion of these concretions.

I am thus brought to speak of the second, and, perhaps, more effectual, means of effecting the solution of cystic calculi—that of injecting the solvent at once into the bladder. It has been before stated, that the force which binds the constituents of these concretions together is easily destroyed. Thus, when merely an amorphous mass exists, not possessing any degree of solidity, the injection of vinegar or dilute acetic acid would readily and at once decompose it; but when consolidation has taken place, other and stronger acids may be used, as the nitric and hydrochloric diluted with water. It has been ascertained by Sir Benjamin Brodie, that by the use of acid injections the irritation of the bladder is considerably allayed, and this I need not say is very desirable.

In cases where the calculus is too large to be withdrawn by the

natural openings, even when dilated, it may be reduced in size by the action of some acid on its surface, which is generally but loosely aggregated; or the coherence of its particles may be weakened by it so that the pressure of the forceps will break the stone in pieces, thus favouring the operation of lithotrity.

This mode of treatment must, at least, be allowed to be reasonable, as it is in strict accordance with the laws of chemical affinity. It has been objected to on account of the extrication of the carbonic acid gas, which, by causing a distended state of the bladder, excites it to contract and expel its contents too quickly; but a great portion of this will, however, become absorbed, and I think it quite possible, by experiment, to obtain a compound which, by decomposing the carbonate of lime and uniting with the liberated acid, would prevent this.

It being well known that several calculi have yielded to solvents, there is an inducement held out to a still further trial of their influence; for cases may occur in which their size will prevent their removal entire, and their hardness resist all mechanical force to break them down.

As a solvent for phosphatic calculi, Mr. S. E. Hoskins has lately advocated the use of some saline substance, the base of which should unite with the acid of the calculus, while the acid of the former should combine and form soluble salts with the base of the latter. It also follows, that such an agent would necessarily be less irritating to the bladder than the acid fluids usually employed. He has found the *nitro-saccharate of lead* very effectual for this purpose; the super-malate or the lactate may also be employed. The salt is to be first moistened with a little acetic or its own proper acid, before solution in water, by which perfect transparency and activity are ensured. The strength of the solution employed by him is one grain of the salt to a fluid ounce of water, which he states has been retained in the bladder, when injected into it, for the space of ten or fifteen minutes, without inconvenience.

It will be evident that the combined acids, when set free, will be neutralized in their nascent state, and thus no deleterious effects be produced on the tissues.

To cause the solution of calculi containing uric acid, Dr. Ure has recommended the employment of carbonate of lithia, urate of lithia being formed, which is a readily soluble salt.

It has been suggested that galvanic action might be resorted to as a decomposing agent, and, theoretically, there is much plausibility in the proposition: indeed, I believe under its influence a calculus has become considerably diminished in size; but I fear the nature of our patients would preclude its employment, and, therefore, one or other of the foregoing means must be resorted to.

URINARY CALCULI IN OTHER ANIMALS.

Cattle.

It is the opinion both of Mr. Youatt and Mr. Simonds, that calcareous concretions are more frequently met with in the urinary organs of cattle than the horse. This may arise both from the nature of the food and their manner of obtaining it by grazing, when calcareous matters being taken in, they will undergo solution by the acid of the stomach, and subsequent elimination, or otherwise, by the kidneys. That the food has much to do with their production, and that this may altogether depend upon some disturbance of the digestive function, appears borne out by an analysis of these concretions. In them we find a larger amount of the phosphates than in those obtained from the horse, otherwise their constituents are the same, namely the carbonates of lime and magnesia and animal matter.

Opposed to the statement of Liebig, who affirms that "the urine of the herbivora contains no uric acid, but ammonia, urea, and hippuric or benzoic acid," Bruecke has discovered the presence of the first-named acid in the urine of the ox, and Mr. Fownes has also noticed it in the urine of cows. It is not considered a pathological product, for it has been found in several healthy animals.

If this receive confirmation, we shall be warranted in expecting the formation of differently constituted concretions from those we have been in the habit of meeting with; and it will also lead to a different mode of treatment, for whenever the urates are found, the use of alkalies is indicated rather than acids. In all the specimens that have fallen under my notice, however, the carbonates and phosphates have predominated.

The remarks made respecting the origin of calculi in the horse, as well as the general symptoms of their presence, will, I presume, apply to cattle. In the pelvis of the kidney they are first perceived to exist, where, remaining, they gradually increase in size, or they descend by the ureters, where they have been known occasionally to become lodged, into the bladder.

RENAL CALCULI.

This kidney of the ox, from the museum of the College, has two calculi in it. The particulars of the case in which it occurred have unfortunately not been obtained.

Mr. Tombs, V.S., Pershore, forwarded to the Association, a portion of a calculous concretion, taken from the pelvis of the kidney

of a cow, which being analyzed by me, was found to be closely allied in composition to the bone-earth calculus. The case is thus given by him in the 12th vol. of *The Veterinarian*, page 242:—

"*July 5th*, 1838.—I was summoned in great haste to attend a beautiful, thorough-bred, long-horned cow, the property of a gentleman in this neighbourhood. I found her breathing laboriously, with a quick pulse—extremities and horns rather cold—refusing food and water—having ceased to ruminate, and frequently lying down and groaning. On inquiry, I found that she was seen by the shepherd, early yesterday morning, rolling about, kicking her belly with her hind feet, and, when free from pain, eating dirt. She had been stall-fed in the winter, and had been turned out in a luxuriant pasture about six weeks. She must have been in extreme agony yesterday, for the grass where she rolled had been forced into the earth, and she had knocked a post and rail fence to pieces with her tremendous horns. As soon as her illness was discovered she was housed, bled to two gallons, two pounds of Epsom salts were given, and injections were administered. To-day I recommended a farther abstraction of blood to the amount of four quarts—the extremities to be well rubbed—another pound of the Epsom salts to be administered, and the enemata to be continued.

"*6th*.—No perceptible alteration. She frequently stretches herself—lies down frequently—the respiration is embarrassed—the rumination suspended—refuses her food and water: the pulse 80. I had her turned out, to see whether she would graze; but she began immediately to eat dirt. She was bled to syncope. I then, as the bowels had not been opened, gave her sulphur, aloes, and Epsom salts, and drenched her with linseed tea.

"*7th*.—Very little change—the bowels still constipated—medicine as before.

"*8th*.—Bowels relaxed, and no mucus mingling with the feces. Pulse 90, and weak. She is still frequently stretching herself. Give her gruel plentifully—she has not had much of it yet, on account of her struggles against being drenched.

"*9th*.—Pulse still 90, and weak. She lies down and moans, and is evidently suffering acute internal pain—feces of a natural consistence—she voids her urine frequently, and it is mingled with mucus and purulent matter. In a quart of urine there are two or three ounces of pus. Give her opium, gum acacia, and carbonate of soda, and drench her with plenty of linseed tea.

"*10th*.—She appears to be somewhat better—pulse not quite so rapid—she has eaten a few elm and cabbage leaves. I had her turned into a grass-field. She grazed for a few minutes, and then began to eat dirt most ravenously. Medicine as yesterday. I am afraid to repeat the bleeding, for she is very much debilitated.

"*11th*.—Decidedly worse. Half of her urine consists of mucus.

purulent matter, mixed with coagulated blood. She has, since yesterday, voided several pieces of coagulated mucus, more than an ounce in weight. The pulse is 90, and somewhat strong; and she will scarcely touch any food. I examined some of her urine that was caught in a vessel, but could not detect any sabulous sediment. As I stood by her she was attacked with violent apparently-gripping pains. She repeatedly turned round—looked back at her flanks, kicked at her belly with her hinder feet—stretching her hind legs out—first the one, and then the other—crouching with her hind parts until her hocks nearly touched the ground—then switching her tail violently, and crossing her hind legs. These symptoms after awhile abated, and then she lay down and snored for a few minutes, after which she got up again, and began to graze in a most voracious manner. I once more bled her copiously—administered enemata, and gave her aloes and gum acacia, for her bowels were again confined.

"12th.—It appears there was a return of the same strange exacerbation of symptoms after I left her. She is now apparently easy, eats and drinks a little, and has ruminated for the first time since she has been ill. The legs and ears are warm—there is a fine dew on her muzzle. The faeces have their natural consistence and character. The urine is still mixed with mucus, but it is voided less frequently. The pulse is 70. Give her linseed tea with opium, and also aloes, to prevent costiveness.

"13th.—Late on the last evening she again manifested excruciating pain, and moaned and rolled about for more than an hour. This morning she is comparatively tranquil. She is more inclined to eat than she has been since the commencement of her illness. The pulse is 72, and the urine no longer mingled with muco-purulent matter. Give opium, sulphate of magnesia, carbonate of soda, and gum acacia, with plenty of diluents.

"14th. — Pulse 65. Eats and ruminates, and is more lively. Continue medicine.

"16th.—Suffers very little pain—pulse 60—appetite improved—the irritability of the bladder apparently diminished, but the old muco-purulent matter is again appearing, and clots of coagulated blood are expelled with the urine. Continue the same medicine and treatment.

"17th.—Pulse 50. Exempt from pain, but the same appearance of the urine. Still continue treatment.

"19th.—Apparently free from pain—feeds and ruminates well, but the urine continues the same. I fear that this is a treacherous calm, for the symptoms too plainly indicate the presence of a calculus in the pelvis of one of the kidneys. I have examined the bladder, *per rectum*, but there was no calculus there. She has also a great disposition to eat dirt still remaining. Reflecting on this, and she still continuing in fair and good condition for the butcher, I advised

that she should be slaughtered. The owner unhesitatingly complied with my request.

Post-mortem appearances.—The contents of the thorax were perfectly healthy. The stomachs, intestines, spleen, omentum, and liver, were also sound. The adipose membrane covering the surrounding fat of the kidneys was inflamed. There was considerable absorption of the adeps, which had a flabby tallow-like appearance. The investing membrane of the left kidney was highly inflamed, and the kidney itself considerably enlarged. Patches of inflammation appeared on the cortical portion of its anterior lobes. The pelvis of this kidney, when cut into, was found to be filled with purulent matter and sandy concretions. The whole of the tubes of the kidneys contained pus of different colours, some being of a pink, some having a yellow hue; but being of a thick and tough consistence, somewhat resembling the white blood found in the heart and large bloodvessels after death from inflammation of the lungs. The tubes of the kidney, before terminating in the ureter, were very much enlarged in caliber.

“The calculi found in the pelvis of the kidney weighed about half an ounce. They were of an irregularly formed porous character, and of a sandy consistence—the outside of a deep and the inside of a light brown colour, and varying in size from a pin’s head to a horse-bean.

“The ureters were greatly enlarged and thickened, and contained some thick deep brown matter.

“The peritoneal coat of the bladder was considerably inflamed. The villous coat was inflamed, thickened, and thrown into rugæ. The mucous coat of the inferior part of the bladder was studded with scirrhus excrecences, some as large as a pigeon’s egg, and all firmly united together, and covered with a thin vascular membrane. They were shaped like the excrecences in the greasy heels of horses. The ovaries were diseased, which is frequently the case in cows that have borne several calves.

“The right kidney I did not examine, the butcher objecting to it, having sold it with the loin. It could not have been in so bad a state as the other, for the fat looked healthy, and the whole was of the ordinary size. The ureter, however, diseased, and containing some purulent matter, was clearly seen.

“The proprietor assured me that the cow had been apparently healthy until the day previous to my seeing her, when she commenced eating dirt. If the sabulous matter that she ate began to assume a calculous form in the pelvis of the kidneys in so short a time, it is completely contrary to the theory generally entertained of the formation of calculi in the urinary organs.”

CYSTIC CALCULI.

A small calculus having passed from the kidney into the bladder acts the part of a nucleus, and, from the nature of the urinary secretion, increment of the mass takes place by the addition of particles either at once derived from it, or from its undergoing a change in the urinary cyst by retention or otherwise, the same laws being necessarily in operation here which have been already sufficiently dwelt upon. The indications of the presence of a stone in the bladder do not, I conceive, materially differ from those observed in the horse; particularly will there be an interruption to the free flow of the urine, which will be frequently voided with pain, and in small quantities, occasionally mixed with blood; at others repeated ineffectual efforts will be made to urinate. The existence of a vesicular concretion being ascertained, "there are," says Mr. Youatt, "two courses to be pursued in such a case—either to slaughter the animal immediately, if it should be in tolerable condition, or to remove the stone by the operation of lithotomy," the operator bearing in mind the difference in the construction of these parts in the horse and the ox. "All attempts to dissolve the calculus by the use of muriatic or any other acid will be as fruitless as they have proved to be in the human being; and the length and small caliber of the urethra, as well as its double curve, prevent the possibility of having recourse to the safe and effectual operation of breaking down the stone in the bladder."

The calculi now exhibited [*see fig. 8, plate IV*] were taken from the bladder of an ox, forwarded to the Association by Mr. J. Carter, V.S., Dereham. The following is the history of the case:—

"I have lately had a case of gravel and diseased bladder in a two-year-old bullock. The animal had been suddenly attacked with violent pains, resembling those of colic: he was continually striking his belly with his hind feet—his tail was elevated seven or eight inches from his quarters—he trembled violently all over, and his bowels were constipated. His appetite up to the very time of the attack, had been good.

"As he had been removed from the farthest part of the farm only a few days before, I thought that the change of food might probably have produced the apparent colicky pains under which he was labouring; but still I suspected that the urinary organs were not free from disease. I bled him, and gave him some opening and fever medicines. In about three or four days he appeared to be well, and was put back with the other bullocks. He fed as usual, and all the unfavourable symptoms seemed to be removed.

"In about a fortnight after this he was again attacked in a similar way, but not so violently as before. I again gave him

some opening and fever medicines. I now observed some small gravel hanging to the hair about the prepuce. He daily grew worse and worse, and at length was taken to the butcher to be slaughtered,

"I send you the bladder as I received it from the butcher, and also some of the calculi that were found in the bladder. The owner saw him opened, and says that there were two or three pailfuls of water in the abdomen. This is very singular, as there were no symptoms to indicate the existence of dropsy while he was living. To the very time of the attack he had been a very straight-bellied, healthy animal. His kidneys were very much enlarged, the neck of the bladder thickened, and both the urethra and ureters contained gravel."

These concretions being examined by me, I found the small dust-like particles, when viewed by a microscope, to appear like so many conglomerate masses of inspissated mucus or gum, each having a small cavity in its centre.

Sections of the larger ones being made and examined in a similar way, presented alternate layers, composed of these smaller particles agglutinated together, probably by animal matter, their nuclei consisting of one or more of the smaller, but apparently perfectly formed, bodies. Thus there is not in the centre of these calculi any foreign substance, as is commonly found in intestinal concretions; but a portion of the like kind of matter, around which the corpuscular forces exert their influence.

Digested in alcohol, or subjected to the influence of this menstruum at the boiling temperature, they did not undergo any visible physical change; and, heated with a solution of caustic potash, or with this alkali in a dry state, no ammonia was evolved.

Acted on by dilute hydrochloric acid, they formed a nearly perfect solution, disengaging much carbonic acid gas, as indicated by the ordinary tests; and very minute flocculi of animal matter were diffused through the fluid. The solution yielded no precipitate with ammonia, proving the absence of magnesia; but with sulphuric acid it did. The inference deducible is, that these calculi consist principally, if not wholly, of carbonate of lime with animal matter.

URETHRAL CALCULI.

"On account of the length, and narrowness, and curvature of the urethra in the ox, obstruction of that passage by a calculus is a circumstance of too frequent occurrence."—*Youatt*.

The following communication from Mr. W. Rush, V.S., Framlingham, so satisfactorily elucidates this position, that, although recorded in vol. 1 of *The Transactions*, cannot refrain from re-

introducing it here. It will be perceived that, in two out of the three cases, the bladders were burst. The morbid parts of the third case, consisting of the urethra containing several calculi, are before you.

“As oxen and cows crop their food so much more rudely than horses do, and are not so particular in their feeding, often swallowing dirt, either accidentally, or for the purpose of correcting or preventing acidity in the *primæ viæ*, we may easily imagine they would swallow much earthy matter, and thus a reason is suggested for the frequent occurrence of urinary calculi in them: and as neat stock are far more liable to all affections of the urinary organs than horses are, the apparent difficulty in the assignment of a cause is at once removed. I will now proceed to detail three cases that occurred under my eye, in which want of experience caused an error in judgment. I have no fear of any advantage being taken of my candour by those I am addressing.

“In September 1840, a farmer requested advice for a bullock, which his usual medical attendant had condemned as incurable. It looked wild about the eyes; the visible mucous membranes were not injected; the ears and muzzle were warm, and the latter bedewed with moisture; the pulse 60, bowels constipated, and there was a loss of appetite. I examined per rectum, and found hæmorrhoids to exist, and the fæces in a hardened state. I ventured to say I thought the animal would recover. Gave castor oil and Epsom salts, which operated freely, and he afterwards fed better. I then ordered two ounces of gentian root in powder, with the carbonate of potash daily. After a few days, the owner thought the beast much improved, and in a week we discontinued our medical treatment; however, he soon again began to lose flesh, and in three weeks was killed. Not having frequent communication with the owner, I was surprised when, some time after, he informed me that the bullock was destroyed, and he found the abdomen filled with urine and the bladder burst.

“The second case occurred last April. A gentleman requested my attention to a beast that had fallen off his feed. The symptoms were not at all urgent; it was, however, bled, and croton and magnesiæ sulph. administered with apparently good effect. Nevertheless, like the last, it did not continue to improve, and in a fortnight was killed. Here again the bladder had burst, and the abdomen contained much urine.

“The week after the loss of this patient, another was attacked in a similar way, and, being destroyed, we begged to be allowed a *post-mortem examination*, when the evil was at once discovered. In the urethra, several calculi, varying in size from a bean to a pin's head, were found. The entire penis I have sent you, with the calculi in it, having abstracted only one for examination, which I find is nearly wholly dissolved by muriatic acid, leaving only

minute flocculi of animal matter. No precipitate takes place on adding a solution of the acetate of lead or of ammonia; nor on the addition of potassa is any ammonia evolved. Under the microscope it presents the appearance of a conglomerated mass of semi-transparent earthy matter. By an operation relief might have been afforded in all these cases, had the cause been known, for I have no doubt but that they were alike.

"I have seen several instances of albumino-sanguineous matter being voided in thick clots by cows in their urine, and which yielded to the oils of juniper and turpentine, with laudanum, given in large doses, with the exception of one, which was accidentally destroyed whilst labouring under the malady; and this afforded us an opportunity to trace the disease to its cause. Her kidneys were found highly disorganized, being literally filled with abscesses, and with the pus was mixed mortar-like calculi, which rapidly effervesced in muriatic acid."

SHEEP.

Mr. Simonds is of opinion that calculous concretions are by no means so frequently met with in sheep as in cattle. The reason of this offers an interesting investigation for the physiologist. Here are two classes of animals, in whom there exists no marked difference in the structural arrangement of their digestive apparatus; they are also depastured on the same soil, and feed on the same herbage: yet in the one calculi shall be frequently found, while in the other their occurrence is comparatively rare. In rams it is by no means uncommon for the vermicular extremity of the penis to be closed by an accumulation of earthy matter, which assumes the appearance of crystallized carbonate of lime. From dirt, and other extraneous bodies adhering to this part, much inconvenience has been experienced; and, from the urethral canal being occasionally rendered impervious by it, over-distention and rupture of the bladder have been known to take place. The common remedy is to snip the extreme end off. I have been favoured with the following history of calculi in sheep by Mr. W. C. Crabbe.

"About four years since, when living at Plumstead, Norfolk, several instances of vesical calculi in sheep fell under my notice, which I will endeavour to give a description of, premising that I did not record any notes at the time, and therefore the statement is made wholly from memory. This will account, perhaps, for the absence of some few particulars, which, being remembered, might have made the cases more interesting; but the main facts are so impressed upon my recollection, that I can safely vouch for their truth.

"They occurred in a flock of about twenty-three score sheep, and

of these animals I had the charge. In the winter of 1839 the flock was divided into what in Norfolk are called heads and tails, or such as were fit to fatten, and such as yet needed time and keep to bring them into fattening condition. The poorer sort, constituting about eleven score, were sent to graze, and to these nothing deserving of notice happened. Such as were kept at home to fatten were fed in folds on cut mangelwurzel and hay, oil cake, brank meal, or buckwheat and white peas, being allowed no water. On this food they became nearly fit for the butcher by the spring, when a few of them were observed to be ailing. The symptoms exhibited were restlessness—frequently getting up and lying down again—repeated and strained attempts to urinate, when but a small quantity of fluid was voided—impaired appetite—disinclination to defend themselves, rather accepting an injury than attempting to repel it; and a solitary disposition evinced by their lying apart from the remainder of the flock. I could perceive no decided symptoms of any known disease, neither could the shepherd recognise any usual complaint. He bled them from the facial vein, but, on a more careful examination, we remarked that the abdomen was considerably enlarged in the vicinity of the penis. All the symptoms above related were observed to be more violent during the night time; and one of them being worse than usual on a particular night, I had him slaughtered on the following morning, it being our custom never to subject to medical treatment an animal that was fit for the knife. On opening the carcass, we found a serous fluid effused between the skin and fascia of the abdominal muscles; the abdominal cavity was not dropsical, but the bladder was highly inflamed and distended almost to bursting. When the bladder was examined, it was found to contain several—I should suppose about eight or ten—soft calcareous masses, which, on being pressed between the fingers, yielded readily. These concretions varied in size from a pin's head to a pea, and, on laying open the urethra, the lining membrane was seen to be inflamed, and the channel in places stopped by more than one of these concretions, which had evidently escaped from the bladder. Unfortunately, no examination was made of the kidneys, as the carcass was intended for the market.

“After this, others became similarly affected, and, the symptoms becoming urgent, they were also destroyed. Their bodies exhibited the like appearances; and in all of them it was remarked that the distress was most perceptible during the night, while, in the daytime, they were only distinguished from the remainder of the flock by being dull and restless.

“During this time no change was made in the manner of feeding, nor in the kind of food given, and I was compelled to have ten or twelve destroyed before my employer called in Mr. Wells, of Norwich. Mr. Crosse, surgeon, of Norwich, who had obtained con-

siderable repute for his knowledge of urinary diseases, happening to be on a visit at the house, was also present, and assisted Mr. Wells in his examination. These gentlemen, I believe, analyzed one of the calculi; but being at that time not much interested in those researches, I do not recollect the conclusion to which they arrived. By their advice, the remainder of the flock was exercised, and placed upon a more limited diet. The first object was readily accomplished by driving them daily to a pond of clear water, and the second by withholding the brank meal and white peas from them. The opinion of Mr. Wells, in which Mr. Crosse concurred, was, that the sheep were so highly fed, that they had become lethargic and too lazy to void their urine, which, by accumulating in the bladder, favoured the deposition of this calcareous matter. After the above change was made in the diet and exercise, but two sheep were slaughtered, and the rest remained unaffected."

Desirous of being in possession of all the information I could obtain respecting these cases, I hesitated not to address Mr. Wells, from whom I received the following reply:—

"Norwich, Jan. 9, 1844.

"Dear Sir,—I am sorry I cannot give you much information respecting the cases of calculi mentioned in your's of the 7th inst., in consequence of their having occurred previous to my coming to Norwich. I am also sorry to say, that no chemical analysis was made of them at the time, either by Mr. Crosse or my late brother. The following, however, is the substance of what Mr. Crosse yesterday told me in a conversation I had with him on the subject. He represents colicky pains to have been present, accompanied with irritative fever, and great difficulty in voiding the urine, also loss of appetite. A post-mortem examination shewed extensive disease of the mucous coat of the bladder to exist, and the cyst itself contained a number of calcareous bodies, varying from the size of a millet seed to that of a large pea. They were sparkling in their appearance, but unattached either to the coats of the bladder or each other.

"Mr. Crosse favours the idea of their being formed in the kidneys, and not in the bladder, an opinion with which I am inclined to coincide. Regretting the brevity of this,

"I am, your's, &c.

"J. WELLS."

To Mr. Morton.

DOG.

Renal calculi are not very common in this animal; occasionally, however, they do occur. Mr. Blaine relates a case in which nearly the whole pelvis of the kidney was found to be occupied by a calculus. Much pain had been experienced, succeeded by emaciation; and whenever urine was voided, it was mixed with blood and mucus.

In *The Veterinarian*, vol. xii, page 245, the following case is recorded by M. Lautour:—

The patient was an old Danish dog. During three or four years he had occasionally voided his urine with some difficulty, and he had walked slowly and with evident pain. He was sometimes better, and at other times worse; but during the asparagus season, and when he was always obliged to eat a considerable quantity of that vegetable, he evidently suffered less pain.

Aug. 20, 1827.—A sudden exacerbation of the disease came on; the dog was dreadfully agitated—he barked and rolled himself on the ground almost continually—he made frequent attempts to void his urine, and which came from him drop by drop. When he was compelled to walk, his hind and his fore legs seemed to mingle together—his loins were bent into a perfect curve—he could scarcely be induced to eat—his flanks were drawn in—and he appeared to suffer very much in voiding his fæces. Milk and demulcent liquids were his only food; warm baths and injections were used; and in six or eight days he regained his usual habits and state of health.

March 13, 1828.—The symptoms returned with greater intensity. His hind limbs were perfectly palsied, and dragged after him—he lost flesh with strange rapidity—and his howlings were fearful and continual.

The same mode of treatment was adopted; but there being very slight improvement after five or six days had passed, and his cries continuing, he was destroyed.

The stomach and intestines were healthy—the liver was of a marbled red colour, and easily torn—the mesentery in some places, and particularly near the sub-lumbar region, was indurated, and of a purple hue. The bladder appeared to be enlarged, not from the quantity of liquid which it contained, but by the thickness and induration of its parietes, the opposite sides of which could not approximate. Its mucous membrane was thickly covered with ecchymoses, the extent of which varied from a pin's point to the size of a thumb. The kidneys were nearly three or four times their ordinary size. Inclosed in the pelvis was a calculus of an irregular form, weighing twenty-six grains. The substance of the

kidneys presented scarcely any trace of their original structure. The calculus was analysed, and contained

Uric acid	58.0
Ammonia	30.8
Phosphate of lime	10.1
Oxalate of lime	1.1
	100.0

CYSTIC CALCULI.

These are by far more common. The one presented to your notice has been forwarded by Mr. Ainslie [*see fig. 9, plate IV*]. The animal when brought to him being in a state of marasmus from suffering, he at once destroyed him, and found this calculus in the bladder. It differs, as you perceive, in its physical characters from all other calculous concretions before you, being made up of crystalline plates radiating from a base. Mr. Ainslie told me of an instance in which as many as twenty or thirty small calculi were taken by him from the bladder; and Mr. Blaine relates another, in which not less than forty or fifty were found in the bladder of a Newfoundland dog. One of them had passed out into the urethra, and had so blocked up the passage, that the flow of urine was prevented, and the animal died of mortification.

The following case is not without interest, and is remarkable for the size of the calculus.

CASE OF CALCULUS IN THE BLADDER OF A DOG.

By Mr. THACKER.

My dear Sir,

Twickenham Common, Nov. 4, 1842.

The specimen I forwarded you of a large calculus in the bladder of a dog may not possess any particular novelty, except as far as its size is concerned. [*See plate III, fig. 1 and 2.*]

The poor animal, which was of King Charles's breed, had not been long in the possession of its owner, when my attention was directed to him. For some time he had been losing flesh, particularly the muscles of the hind quarters; at last the marasmus became great, and he was observed frequently to void urine in small quantities, and with some degree of pain. It presented no traces of blood, but was rather higher coloured than natural. Paraphymosis also existed, and consequently I was led to infer that the cause of the extreme emaciation would be found in the urinary apparatus. My friend and late preceptor, Mr. Simonds, being present, he quickly ascertained that a large concretion existed in

the bladder, for which an operation would have been had recourse to, could any hope have been entertained that the animal would have survived it; but, such hope being precluded from the size of the calculus, and the debilitated condition of the patient, it was deemed most humane to advise the owner to have him destroyed. While waiting for his consent, my treatment consisted merely of palliatives: a dose of laxative medicine was given, the bowels being constipated, and fomentations applied to the penis, so as to reduce the local inflammatory action. Death proved the correctness of the diagnosis.

I am sincerely, your's, &c.,

To Mr. Morton.

W. THACKER.

The *form* of this concretion is that of a flattened ovoid, the depression being on its shorter axis. Its *weight* is $12\frac{1}{2}$ drachms. Its *structure*, layers concentrically arranged, in which radiating lines may be seen, and between the lamellæ minute sparkling crystals. Its *colour*, light brown; its section shewing some of the layers to be darker than others. Its *composition*, the phosphate of lime with ammonia and lithic acid; for I find that a fragment acted upon by the flame of the blow-pipe first blackens, then becomes white, and a portion of it gradually disappears. The residuum undergoes solution in dilute hydrochloric acid, and, when neutralized, yields an abundant precipitate on the addition of oxalate of ammonia. Excess of ammonia causes it to gelatinize.

Another portion, heated with caustic potash, yielded the odour of ammonia, and the solution, on the addition of hydrochloric acid, gave a precipitate of lithic acid, the presence of which was farther proved by nitric acid giving to it the characteristic pink colour.

I am inclined to think that a more minute analysis would shew these constituents to be arranged in the different laminæ, which will account for the difference in the colour of the layers.

It is not at all surprising that the constituents of both renal and cystic calculi in the dog should differ from those met with in the herbivora, when we reflect on the nature of the aliment and the peculiarity of the organization of these animals. They are often similarly constituted to those met with in the human subject. Fourcroy found one to consist of the lithate of ammonia, and the phosphate and oxalate of lime.

PART III.

OCCASIONAL CALCULI.

There is little doubt but calculous concretions may have been found within most of the glandular structures of the body or their conduits; the symptoms, however, that indicate their existence are often very obscure, or they are so situated as to preclude all means of removal.

The following case, I believe, stands alone in the annals of veterinary medicine. It is recorded in *THE TRANSACTIONS OF THE ASSOCIATION* for 1842, and I extract it nearly entire, with the comments it gave rise to.

PHLEBOLITES IN THE JUGULAR VEIN OF A HORSE.

By Mr. J. B. SIMONDS.

The patient was a dark bay horse, fifteen hands three inches high, and about twelve years old. Mr. Simonds was requested to see him on the 3d of November 1842. (The remainder of the case will be given in his own words.)

“Mr. Thacker, who was with me at that time assisting me in conducting my business, first visited him; but considering it to be a case of a very unusual kind, he returned home, and requested that I would see him prior to any remedial measures being adopted. On my arrival, I found that the animal had been used by a gentleman for two or three weeks as a job horse, and, until within a day or two of the attack, no illness had been observed, but, on the contrary, the horse had gained flesh, and gone on well. At that time the coachman observed lameness in the near fore leg, and found that the horse did not go to the collar so readily as he had been accustomed to do. When Mr. Thacker first saw him, the symptoms were—total loss of appetite; the pulse at the jaw accelerated, but faltering; a kind of pulsation in which the practitioner rarely feels himself warranted in detracting of blood; at the heart the pulsation was fuller, in number 65; the respiration was languid and heavy; the extremities were not particularly cold, and the visible mucous membranes were slightly injected. There was a peculiar spasmodic contraction just anterior to the left spinous process of the ilium—a jerking action, as if connected with the internal abdominal muscles. There was also a degree of tenderness on the right side, over the region of the liver; and obstinate constipation of the bowels, but no turning of the head to the side, nor any desire to lie down, although he was evidently suffering from abdominal pain. No lameness of the leg

was at this time observable, but there was a resting of it. From the general symptoms, I was inclined to think that the illness arose from some derangement of the digestive organs, more particularly of the liver, not, however, amounting to hepatitis; and notwithstanding the peculiarity of the pulse, to which I have referred, the symptoms otherwise warranted me in attempting to withdraw blood. I, therefore, directed Mr. Thacker to open the left jugular vein, in order to ascertain what would be the result. Keeping my hand at the side, I watched the pulsation at the heart. The vein was readily opened, and the blood for an instant flowed out of the vessel freely, but as quickly ceased. By keeping up the pressure, similar effects were produced. Finding that the animal did not bleed readily, I left his side, in order to examine the vein, and immediately detected the presence of an enlargement a little above the entrance of the jugular into the thorax. At first I was inclined to think that there had been inflammation of the vein, and that other conduits were taking the blood from the head to the heart; in fact, that there was an obstruction to the flow of blood through the vein. But on examining more minutely, I discovered this tumefaction to be caused by tumours, which at first sight bore a strong resemblance to enlarged absorbents. This horse had been a short time previously in a stud where there were several cases of farcy and glanders, and hence I was naturally led to infer enlarged absorbents; but on a still more careful examination, they proved to be tumours within the jugular vein. You may now see their situation: they are very evident, and placed about half way down the neck. When I first detected them, they were somewhat lower down than they are now. But you will observe that, by applying pressure beneath them, they can be passed up the vessel. There is one which I now pass into the superior branch of the jugular vein, but, on removing the hand, it falls back again into its original situation. The other two tumours are evidently not connected with it. It appears to me that these tumours are somewhat of the nature of polypi, and are attached to the inner tunic of the vessel by peduncles. If my supposition be correct, it proves that there are no valves in this vein between the situation now occupied by these tumours and the point to which they can be raised; for although valves would allow the blood to pass down, they would as certainly prevent these tumours being passed in a contrary direction. If the peduncle be two inches long, of course it will allow the tumours to pass over a space of four inches. Elevating the whole of the tumours evidently gives the animal pain. Thinking that the case might not be uninteresting to the members of the Association, I ventured to send the horse to the College, and, on the road, he unfortunately became lame again in the near fore leg.

"It is interesting to inquire whether the lameness is referrible

to any accident he has met with, for there now seems to be some slight inflammation in the fetlock joint; or whether it is connected with these singular productions. But taking the fact of its being an ambiguous case in the first instance, and of its being recognized by a loss of power, or a degree of lameness in this extremity, also of this horse not having done any work from that period, and then having become lame again when he had walked about four miles on the road hither, it does appear as if we might be almost warranted in concluding that some obstruction exists to the natural flow of blood in this limb, and which may account for the lameness. I have been inclined to think that the whole of the animal's illness has been referrible to the existence of these tumours; for if they exist in the jugular vein, they may be present in other vessels, and I think it is more than probable that they are. Mr. Spooner, your President, has informed me that in his dissections he has detected similar productions in the abdominal veins. Here they occur in the jugular vein of a living animal, and are, as you see, about the size of a large nut. On grasping them firmly, they are found to be very hard and unyielding. Although pressing them gives the animal pain, yet it does not produce so much as we might have expected. The proof that they are attached by peduncles is satisfactorily demonstrated by the fact of their not falling down the vessel—not going on with the current of blood. As the caliber of the vessel readily admits of their passing upwards, so it would of their passing downwards, were they not attached by a footstalk. It is this which prevents them falling down into the heart, and thus at once putting an end to life by their presence in that organ.”

[This horse was subsequently purchased by Mr. Simonds, and destroyed, on account of there being “but little probability of his ever becoming useful again.” The diseased parts having been removed, the following description of them was given by Mr. Simonds:—]

“You will observe the jugular vein in which the tumours were situated [*see plate II, fig. 4*], and which you will remember were about half way up the neck, and that they admitted of being passed up the vessel as high as its bifurcation. On the pressure employed to elevate them, however, being removed, they immediately fell down to their original situation; but all our efforts to push them further down were ineffectual. The post-mortem examination at once proves why this should have been the case, for the vessel is impervious below the part they occupied, from lymph having become thrown out, so that no blood could pass down it. The obliteration extends from that part where the tumours were situated down to that portion where the axillary vein unites with the jugular, so as to enter the anterior vena cava.

“The tumours themselves I have before me [*see plate II, fig.*

1, 2, 3]. They are three in number, and varying in size as well as in shape. They are very dense, and on making a section of one of them, which has been effected with some little trouble, it appears to be composed of bony matter, or some of the earthy phosphates; but Mr. Morton has undertaken to analyze one of them, and he will make known to you its composition.

"The origin of these tumours must ever remain somewhat shrouded in mystery, and different views will be taken by different persons of their formation.

"At the time I introduced the case I thought they were pedunculated, but in this it appears I was mistaken. Whether they originally possessed a peduncle which, becoming ruptured, allowed them to fall down the vessel to a certain extent, and nature, to prevent them from descending further, threw out lymph; or whether they might not have been produced from the vessel becoming impervious below, from some injury or pressure caused by the collar; are questions for your consideration. This animal had been accustomed to the common duties of a coach horse, and had been working for some time in one of the Brighton stages.

"The weight of the tumours, taken altogether, is not quite fourteen drachms. The large one weighs just six drachms and a half, and the small one but one drachm and a half.

"Being desirous of examining the heart, in order to see whether it, or the vessels immediately proceeding from it, had undergone any change, your President has made a section of it, and, I believe, there is nothing abnormal to be observed; but the jugular vein being impervious, and these tumours occupying it, I should not have been surprised if we had found the valves of the heart affected. I believe, however, that the semi-lunar valves opening into the aorta and the pulmonary artery are perfectly healthy, as well as all the others.

"It is questionable whether these tumours possess a distinct organization. One would be almost inclined to conceive that they did, for, otherwise, they would have acted as foreign agents, and inflammatory action would have taken place, and a sloughing of the coats of the vein in order to allow of their escape. This not being the case, and their existing for the long time they must have done in order to attain their present size, are, I think, clear proofs that they possess a distinct organization. If I am right in this deduction, then I consider this to be one of the best proofs that can be adduced of the life of the blood. The fibrous part of the blood in the first instance was thrown out from the inner part of the vessel, and this became organized; so that thus they possessed organization within themselves. Their general appearance, with their not having any thing like a peduncle, is, I think, almost a positive proof that such was the case. It is, however, a matter of specula-

tion whether they thus had their origin or not; but the promised analysis will tend much to set the question at rest.

"The disease to which our attention was first directed arose from derangement of the digestive organs. I told you the liver was the principal seat of this affection, and the post-mortem examination also bears that out. This organ is very considerably altered in its shape, and parts of it appear to be in different stages of disease. When the horse was in the College, both Mr. Spooner and myself were of opinion that there was a softening of the liver, and that hæmorrhage had taken place beneath the peritoneal covering, and, by forming a coagulum, had prevented its escape into the abdominal cavity. Many parts of the viscus now establish the correctness of this prognosis. The peritoneal tunic is thickened, from the chronic inflammatory action which has been going on in it. It shews that the symptoms, ambiguous as they were, were, nevertheless, sufficient to point out this organ as the principal seat of the affection.

The greatest change, however, in the organ, except its shape, is the formation of an encysted tumour, which, by taking an external view of it, appears to contain pus. My impression is, that, had the animal lived much longer, an abscess would have been formed in this situation, this being the beginning of the process. On making a section of the encysted tumour, however, I find that instead of its containing pus, which one would naturally have expected, it is coagulated blood. This is an interesting circumstance, and proves still more clearly the correctness of our opinion. There was hæmorrhage from the liver, and blood has been thrown into this cyst. The underneath part of this immense coagulum of blood is likewise surrounded by a dense membrane, thus forming a sacculated receptacle, into which blood was thrown. It is, perhaps, interesting to inquire whether this peculiar state of the liver was not referrible to a morbid change going on in the blood-vessels, and more particularly in the jugular vein. [*see plate II, fig. 5*]

"You will remember, that, at the time the animal was exhibited to you, lameness in the near fore leg was present, and that very severe. That was supposed to be attributable either to the condition of the bloodvessels, or to some injury the animal had received. The examination of the leg shews that there was inflammation of the synovial membrane of the fetlock joint, as well as inflammation of the lining membrane of the mucous capsules, as they are called, but no local injury."

Mr. Spooner.—In illustration of the highly interesting specimens before you, I may be permitted to read an extract which appears in the first number of the "Transactions of the Veterinary Medical Association," taken from the *Cyclopædia of Practical Medicine*.

"Phlebolites often attain the size of a common pea; more fre-

quently they are smaller, and sometimes they do not exceed a millet seed in size. Otto states that he saw one in the Anatomical School, at Strasburgh, of the size of a hazel-nut. They are usually of a yellow colour, and consist of concentric lamellæ, and are more frequently of an oval than a round shape. According to the analysis of John and Gmelin, they are principally composed of carbonate and phosphate of lime with animal matter. Dr. Prout has more recently analyzed some of these concretions, and his results are nearly the same.

"A difference of opinion has prevailed respecting their formation. Mr. Hodgson thought it not improbable that phlebolites were formed in the surrounding parts, and found their way into the veins by progressive absorption. Mekel entertained an opinion that they were formed like encysted tumours. Andral states that *calculous concretions sometimes push the internal membrane before them, and descend with them into the cavity of the vein. The membrane, he adds, becomes thin, and forms a true peduncle to the concretion.* There is the closest analogy, M. Andral thinks, between these pedunculated concretions and those concretions sometimes met with in the interior of the joints; and he inquires whether it may not be possible for these bodies sometimes to detach themselves from the coats of veins and become loose in the cavity. Tiedmann believes them to be formed from the blood itself. This opinion, Otto states, is also supported by the observations of Errhman, according to which some of the concretions were still soft, and appeared to be formed from the fibrous matter of the blood, a mode of formation Cruveilhier had previously noticed. That this view of the mode by which phlebolites are formed is correct does not admit of dispute; and Dr. Carswell has instituted drawings to represent the different stages of their formation. The observations of Dr. Carswell prove, that there is first formed a small coagulum of blood in the vein, and that in the centre of this clot a little nucleus of concrete layers gradually appears. By-and-by the red part of the blood is absorbed, and fibrine makes its appearance, with the usual physical characters. Then a certain arrangement can be perceived taking place in the fibrine, forming lamellæ, the central one first formed apparently becoming cretaceous; and this cretaceous induration takes place throughout the different lamellæ until the whole is converted into a solid phlebolite. In the point towards the distal extremity of the vein there is sometimes a little nucleus of blood, or fibrine, which becomes a concretion: and thus the phlebolites get a caudal extremity.

"But in what manner the blood becomes coagulated, so as to give origin to the formation of phlebolites in the veins, is not so easy to determine. That this is sometimes the result of a slight degree of inflammation or irritation propagated from diseased organs along the vessels, is highly probable from the facts already

noticed respecting the consequences of phlebitis. It must, however, be admitted that, at the part where the phlebolite is formed, there is in general no perceptible alteration of structure in the surrounding coats of the vein, although it has been employed in bringing back the blood from a diseased organ."

From the perusal of this extract, it appears that these tumours are precisely analogous to those that are described as phlebolites, or vein-stones.

Now, with reference to the existence of them in the jugular vein of the horse, from whence these were taken, it has been before stated by Mr. Simonds, that, during the life of the animal, he was not aware that any disease of the vein ever existed. Post-mortem examination, however, clearly shews that the lower extremity of the vein has become completely imperforate. This is remarkable from its situation. Had this imperforation existed higher up, we should have concluded at once that it was the result of phlebitis, produced by bleeding; but existing, as it does, so low down, in fact, in the pectoral region, we cannot for a moment entertain the idea.

It is difficult to account for this state of the vessel. We might at first be inclined to think it was caused by those peculiar concretions which, acting as irritants, excited inflammation in it; but, on due reflection, we shall be induced to ask ourselves this question:— Suppose the existence of the tumours in the vein preceded the morbid state of the vessel, what preventive would there have been to their passage at once to the heart, thus producing disease of that organ rather than of the lower extremity of the jugular? In the present altered condition of the vessel, you have an opportunity of seeing how it was that the tumours could be easily elevated from the sacculated portion of the tube to its upper extremity; but immediately the pressure was removed, such was the force of the column of blood upon them, that they fell down rapidly to their resting-place below. This very simple fact, the quick passage of these bodies, large as they are, to the lower or constricted portion of the vein, although the current of blood had been stopped in its progress to the heart, proves, I think, that they could not have been formed previous to the diseased state of the vessel.

This view establishes another important fact; namely, the necessity of considering the mechanical forces that are operating in the flow of blood through the venous system. It is a subject on which I have lately been lecturing. You are aware that much stress is laid upon the dilatation of the auricles of the heart, by which, it is said, the blood is drawn into these cavities by the power of suction, as it is termed.

When we consider the size of the jugular vein, and its near approximation to the auricles, we shall be inclined to admit that,

if any effect is caused by the dilatation of the latter, it must be communicated to the former; but in this instance, from the vein being impervious, some other cause must be in operation to enable us to account for the momentum with which the blood passed to this particular part, impelling the tumours with it. I say, then, that if these tumours had existed before the vessel became impervious, they must have passed on to the heart itself, unless, in their first formation, they possessed a pedunculated attachment to the inner surface of the vein. You will bear in mind, from the extract just read, it is stated that it has been considered by some persons highly probable that in some instances the peduncle, which connects these tumours with the inner surface of the vein, may have become absorbed or lacerated, and thus allow them to float within the vessel. It is certainly not impossible that this may have been the case here. They may have been formed in the coats of the vein, and, being foreign agents, have produced disease in that vessel and the surrounding parts. And yet I should be inclined to think that such was not the case; because, if, when having an attachment to the vein, they acted as foreign agents, producing irritation and inflammation, thus rendering it impervious, why should they not still continue so to act? Indeed, there would be greater reason for concluding that, when detached, they would become greater irritants than they were before.

We know that they existed for a long time while the animal was under the care of Mr. Simonds, and no doubt previously. It is impossible, therefore, not to infer that the disease of the vein preceded their formation, and consequent upon this disease of the vein a coagulum of blood was formed, arising from the separation of its fibrine, which, becoming organized, a deposition of earthy matters took place, and thus were formed the tumours you see before you.

There is, certainly, a remarkable peculiarity connected with their structure. And Mr. Simonds has justly observed, that, if these tumours were formed separate and distinct from the tissue of the vein, it is at once a conclusive proof of the vitality of the blood. But whether they were so formed or not is, of course, mere conjecture. We cannot arrive at any certain conclusion here; but I think, taking a general view of them, that they were formed independently of the coats of the vein. The one opened is evidently surrounded by a dense fibrous structure, and on its inner surface is deposited this peculiar material, which I now presume to be some of the earthy phosphates. It becomes a question, whether the contents of the tumours were first separated from the blood, and subsequently their investure formed for the purpose of giving a smooth surface to them, thus enabling them to move more freely over the inner coats of the vessel without producing irritation;

or whether the capsule itself was first formed, and the contents then deposited in it. I should incline to the opinion that the former was the case. If the fibrous sheath possesses organization, which I presume it does, still it is of a very low degree—an organization not likely to tend to an increase of bulk. It seems then, to me, that the substance constituting the main bulk of the phlebolite was first formed, and then, afterwards, by an act of nature which I am at a loss to describe, the capsular substance was placed around it.

If we connect these tumours with the diseased state of the liver, it will be recollected that, in the extract I have read, it is stated that, probably, the same formations may exist in some other parts of the body. Thus a coagulum of blood may have escaped and found its way into other venous trunks, and given rise to the like formations, remote from the part primarily affected. But although on taking a cursory view of this diseased liver, it might be thought that the origin of the substances found in the vein was there; yet, when we take into consideration that the blood of the liver is proceeding directly to the posterior cava, the probability would be that such formations, if they had their origin in the liver, would be more likely to be found in the trunk of that vessel than in one of the jugular veins. I repeat, it is very improbable that they should be found in the jugular vein under such circumstances; it is even more likely that they would be found in those parts of the body where they are usually said to be met with in the human subject. I lately held a conversation with Dr. Elliotson upon this subject while the horse was at the infirmary, and he told me that these tumours were frequently found to exist in the pubic and pelvic veins of the human subject.

But whether these tumours are analagous to those remarkable formations called phlebolites or not, I consider that this is an unique case—a case with which not a single one on record in the annals of veterinary medicine bears comparison: for in all the instances quoted, as being met with in the human subject, these vein-stones have never been found larger than a pea, with the exception of one which was as large as a nut. When Mr. Simonds first mentioned the case to me, I informed him—and I repeat it now, after a post-mortem examination has been made—that I had occasionally met with tumours on the inner surface of the veins of the abdomen, but these always had a pedunculated attachment; they never exceeded the size of pea, and were of a pyriform shape. These appeared to be formed from the internal lining of the vein, and to have contained fatty matter. Such instances as these I have seen, but I never saw a case analogous to the present. It is highly interesting, both with reference to the diseased state of the vein, the formation of these bodies, and the abnormal

condition of the liver. Most of you, also, had an opportunity of observing the symptoms during the life of the animal: the yellow state of the mucous membranes, the singular character of the pulse, and various other peculiarities, which are unnecessary now to be named by me.

There is, however, one thing I omitted to mention with reference to phlebotomy being likely to produce these concretions. I am sure there are many present who have had cases of inflammation of the jugular vein placed under their care, and some of you may have had recourse to lay open the vein and extending the incision as far up as might be found necessary. This has been the practice adopted here for many years past, and, generally speaking, it has been attended with success, but not invariably so; while at all times the cure of such cases has been much protracted.

When there is inflammation of the jugular, and a coagulum of blood has formed within it, I think it highly probable that portions of the coagulum may become detached, and by organization form these bodies.

Mr. Morton stated that he had, as requested, analyzed a portion of one of the phlebolites.

Its investing tunic, he found, was made up almost wholly of albumino-fibrin. A portion of its interior being boiled for some time in distilled water, did not undergo any perceptible change whatever, nor did it impart any sensible properties to the water. In a solution of caustic potassa it became dark coloured, but emitted no ammonia. Another portion, about five grains, being placed on a piece of platinum foil and subjected to the influence of heat by the aid of a blow-pipe, blackened, and threw off copious exhalations having the odour of burning animal matter. It then became white, and on being weighed was found to have lost nearly one-half its weight. The residuum quickly dissolved in dilute hydrochloric acid with effervescence, and the gas eliminated rendered lime-water turbid. The solution being filtered and rendered nearly neutral, the oxalate of ammonia threw down from it an abundant precipitate, and on adding an excess of water of ammonia to it, gelatinization took place.

The microcosmic salt threw down no precipitate; and the hydrosulphate of ammonia caused no discolouration, proving the absence of the metallic oxides.

The inference deducible from the above analysis is, that the concretion consists of animal matter nearly one-half, the remainder being the phosphate and the carbonate of lime.

Gmelin subjected some phlebolites taken from the human subject to analysis, and found them to consist of,

Animal matter	27.5
Phosphate of lime	53.5
Carbonate of lime	15.5
Magnesia and loss	3.5

100

He could not refrain from expressing his concurrence with the view Dr. Carswell had taken of the formation of these bodies, which is, that they have their origin in the coats of the vein; and he thought the concretions adverted to by the President at the last meeting were very likely to be phlebolites in the early stage.

It was the structure of these vein-stones that more particularly induced him to come to this conclusion. The one laid open by Mr. Simonds shews a series of layers, but not around a common centre, which he thought would be the case if they were formed directly from the blood; but these layers of animal matter are superposed one upon another, and the outer one, that which is in contact with the membrane enclosing the mass, has much the greatest quantity of earthy matter in it. He also considered them to possess organization, although in a very low degree, and once to have had peduncles by which they were attached to the vein, although certainly not a vestige of any is now to be seen. Their shape also favoured this view as well as the position of the lamellæ.

The concretion I now place before you [*see fig. 10, plate IV*] has also been given me by Mr. Simonds. It is reported to have been taken from the thoracic duct of a horse, in which were two of them. The history of the case further is unknown to him. It appears to be made up of the phosphates, and is invested with a membranous covering.

These calculi [*see fig. 11, plate IV*] were removed by Mr. Barth from the spongy portion of the clitoris of an ass. Their composition is urate of soda and phosphate of lime, and they are the only accumulations in which I have met with any of the uric acid compounds in our patients, except the dog.

BILIARY CALCULI.

From the absence of a gall-bladder, and the comparative simplicity of the biliary apparatus in the horse, bile-stones are of very rare occurrence in that animal. Occasionally, however, in the ductus communis choledochus, the bile would appear to accumulate, and, being retained there, it undergoes inspissation, of which this preparation from the museum affords a proof. The following case, by Mr. J. Purves, of the Hon. East India Company's Service, in which

not only the biliary duct, but also its ramifications, were filled with bile-stones, is one of considerable interest.

The animal—a cast troop-horse—had been for more than twelve months the subject of frequent severe abdominal pains, of which he was as frequently relieved. For the three months previous to the present attack he has been apparently well. When sent from the picket, he was observed to be very weak and low in condition. The symptoms otherwise present are, frequent lying down and rising again, much uneasiness, slight diarrhœa; pulse quick, but excessively feeble; picks a little grass occasionally. Gave an antispasmodic and stimulant draught containing the spirit of nitric ether and opium. On the next day, no remission of the unfavourable symptoms; much abdominal pain still present; diarrhœa established, accompanied with tenesmus, and followed by prolapsus ani; debility extreme, and no hope entertained of ultimate recovery. Repeated the draught, and applied counter-irritants to the abdomen. Ordered rice-water for his drink. At four in the afternoon the animal died.

Post-mortem appearances.—Stomach slightly inflamed, and its coats thickened, with indications of an abscess having existed in it. Duodenum of a black colour, indeed going on to gangrene, particularly where a gall-stone the size of a very large duck's egg was lodged*; the lower portion of the ileum considerably increased in thickness. The other intestines not much diseased, excepting the peritoneal tunic, which was inflamed throughout, extending to the omentum and mesentery. The liver in a dreadful state of disease, being extensively disorganized, much indurated, and weighing thirteen seers, its ducts also filled with gall-stones.

THE OX.

Gall-stones are common in the bladder of the ox. They appear to be composed principally of cholesterine, and vary in size from that of a pea to a walnut. They are much sought after by artists as a pigment, on account of the rich colour they afford.

SHEEP.

Landerer examined one of these concretions from a sheep. It weighed twelve grains, was outwardly of a brownish yellow colour, inwardly black with green spots. It tasted bitter, and coloured the saliva yellow; fused when heated, swelled up under evolution,

* Was not the escape of this the cause of the present acute attack, and may not others have preceded it? It is well known that the passage of a gall-stone in the human subject is accompanied with excruciating pain.

of a musk-like smell, and left behind a porous charcoal mixed with lime-salts. By means of alcohol Landerer extracted 70 per cent. cholesterine; the residue contained gall-mucus, resin, and colouring matter, with phosphate and carbonate of lime.

Mr. Erasmus Wilson, in a paper on the normal anatomy of the liver, in the *Cyclopædia of Anatomy and Physiology*, speaking of these concretions, says:—

“The formation of biliary calculi may be referred to disproportionate secretion of the natural elements of the bile, the increased quantity of certain of its constituents giving rise to the deposition and accretion of these substances in a form corresponding with the cavities in which they are produced. Gall-stones have been found in the smaller biliary ducts in the substance of the liver, in the excretory ducts both within and external to the organ, and in the gall-bladder. They have also been met with inclosed in a cyst, formed most probably by the obliteration of one of the hepatic ducts, and adherent to the organ or suspended from it by a pedicle. Malpighi found gall-stones in the small biliary ducts, and considered them as petrified lobules. The *size* of biliary concretions is very various, being sometimes exceedingly small, and at other times of considerable bulk. When small they are generally numerous: I have counted upwards of a hundred, and instances are recorded where more than a thousand were found in the gall-bladder. When they are large they are few in number, and frequently single. I have seen the gall-bladder filled with three, two, and even one large calculus. A large oval gall-stone now before me, equal in size to a pigeon's egg, I removed from the ductus choledochus. Their *form* is equally various with their size and other physical characters. I have now before me gall-stones with a flattened shape, triangular, and tuberculated on the angles and on the surface; others have three equal facettes with sharp or flattened or rounded angles; others, again, are irregular in their outline, and would seem to be moulded to the canals and cavities from which they have been withdrawn. Being stained by the colouring matter of the bile, their *colour* varies with the predominant tint of the secretion in which they have been formed;—hence some are reddish brown or black; others are yellow, and others again white; some are mottled yellow and black, or white and black with various shades of green.

“In chemical composition there are, according to Andral, five principal varieties of biliary concretions: they are, 1, of yellow colouring matter; 2, of resin; 3, of cholesterine; 4, of picromel; 5, of phosphate of lime. The first kind appears very ill founded, for yellow is a prevailing tint among gall-stones, and is the mere pigment by which cholesterine and the other substances are coloured. By far the largest proportion of gall-stones are formed of cholesterine, either pure, when it presents a white semitrans-

sparent mass beautifully crystallized in its interior, or variously tinted with brown, yellow, or orange, and radiating from the centre towards the circumference or from a small central nucleus. The smaller calculi also exhibit upon fracture the same radiated appearance. The gall-stones of resin and picromel may be classed together, and considered as biliary concretions formed of inspissated bile, probably accreted through the agency of cholesterine. The calculi of salts of lime are less frequent; they are found in the gall-bladder, or in the ductus communis choledochus. I have observed them to present two varieties;—first, incrustations of phosphate of lime upon the surface of calculi of cholesterine; and, secondly, laminated calculi composed of concentric layers of phosphate and carbonate of lime variously coloured and having a central nucleus. The latter form is, I believe, rare:—I possess but one specimen; it is of large size, and rough and irregular upon the surface."

SALIVARY CALCULI.

Mr. Percivall, in his *Hippopathology*, says, "British veterinary practice appears to have been eminently unproductive of cases of this description. Were it not for the superior advantages of observation possessed by continental veterinarians, we should have felt at a loss in what way to have supplied this place in our nosology."

It will be remembered, that Professor Mazza, a short time since, presented to the library of the Association an Essay on a Calculus of this kind, and I am indebted to Mr. W. Ernes for the following translation of it.

HISTORY OF A SALIVARY CALCULUS,

By VINCENZO MAZZA, Professor of Veterinary Medicine, Naples.

(Translation.)

On the 27th of October, 1842, I was invited by his Grace the Duke of MIRANDA to his magnificent villa of SANTO JORIO, to examine and extirpate a hard and indolent tumour situated on the left cheek of a fine bay mare, six years old, of English breed, and which detracted much from the beautiful appearance of the animal. The tumour was of a conical shape, its base towards the lips, its

situation being a little above the commissure, and its apex approximated the masseter muscle; it was a little depressed in the centre, and entirely covered by the skin, which was perfectly healthy. Explored by the hand, it seemed to move in every direction, and was hard, indolent, and cold to the feel.

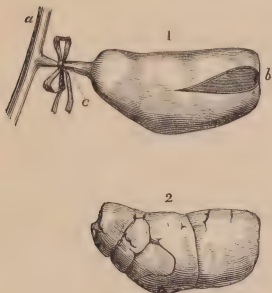
Considering the distance of the stenonian duct, it did not occur to me that it might be, what it afterwards proved to be, a salivary calculus; for I thought it a tumour of the strumous kind, connected with the mucous membrane of the mouth. From what I could learn of its origin, it seemed that, about twelve months previous, a small lump shewed itself, of which, however, no notice was taken, and it had gradually increased to its present size.

On the following day, having properly secured the mare, she being very high-spirited, I made a more minute examination of the parts, and found that the tumour possessed the hardness of stone, and, on pressing it between the finger and thumb, crepitation was heard. This second examination corrected the mistake of the first, and I had now no doubt of its being a calculus, but of what nature I could not determine, as all the parts seemed in their normal state, and the distance of the salivary glands and duct did not lead me to suspect that it was a salivary calculus; but as some explanation of its nature seemed required, I satisfied my employer by supposing it to be one of those accidental bony concretions which are so often observed in the different tissues of the body, and of which the lungs, liver, and even brain, are not exempt*.

The mare being duly prepared, on the 29th I proceeded to the operation, being assisted by Sig. J. Gentile, Veterinary Surgeon, and my nephew, Pompio Mazza. Having cast the animal, and fixed the head in the best position I could, I first removed the hair, after which I made an incision at the base of the tumour, and, following its horizontal direction, thus laid open the sac, and exposed the calculus to view, which was extracted in five pieces by means of a pair of dissecting forceps. The last but one of these pieces was of a lighter colour than the others, porous and rough; a proof that its formation was not perfected, and that, had the calculus not been extracted, it would have undoubtedly increased in size.

The calculus weighed three ounces two drachms and a half. [*See woodcut, fig. 2, in which it is represented much reduced in size.*]

* At the veterinary school of Milan there is shewn the brain of an ox which is entirely ossified, of which, however, the cerebellum is wanting. It is of the shape and colour of the natural brain in its healthy state, but so hard, that pieces can only be chipped off; and what is surprising, it seemed that the animal must have been in perfect health, as it was only discovered by the butcher when he opened the skull to sell the brain.



I now introduced my finger into the sac, but could not discover any sinus, although the cavity seemed to extend upwards. I therefore closed it with a suture, thinking that it soon would become obliterated by the suppurative process, and, a suitable bandage being applied, the mare was released and removed to the stable.

On the following day I visited my patient, but had scarcely entered the stable when I perceived the dressings to be completely saturated. I inquired if any fomentations had been applied, and being answered in the negative, it occurred to me that it must be saliva that was escaping: to ascertain this, I removed the dressings, and ordered a few oats to be given to the animal, when the act of mastication removed all doubts, by causing a copious flow of saliva to pass through the sac. I now had to combat with a salivary fistula, which is at all times difficult to cure.

I acquainted his Highness the Prince of Ottajano, father of the youthful Duke of Miranda, who was present, of this unexpected aggravation of the case, and after consulting together, we referred to the beautiful plates of M. Leblanc, which were in the possession of his Grace, by which I succeeded in shewing that the distance of the stonionian duct afforded no ground for conjecturing that a salivary calculus could be formed here, and that the present case was such as to lead the most experienced practitioner into error. My first idea now was to apply pressure, in order to prevent the saliva from flowing into the sac, and to cauterize the latter, so as to produce an abundant suppuration. I was certain that the salivary duct was perfect, and communication with the mouth unobstructed; if, therefore, I could by mechanical pressure prevent

the saliva from deviating out of its natural course. I anticipated that the sinus would become obliterated. I at once put this into practice, but soon found that it was difficult to keep constant pressure on the part; and, moreover, to my great annoyance, the saliva continued to escape. I then fancied that an artificial opening might be made at the point of communication, and the saliva made to flow into the mouth by two openings, the natural and an artificial one, thus depriving the sac of this secretion; but this presented so many difficulties, that it was soon abandoned by me. I now resolved to employ a ligature, which was done. On the 9th of November, the patient being cast as for the first operation, I introduced a probe into the sinus, which was maintained in its place by an assistant, and then made an incision through the skin, and applied the ligature as close as possible to the salivary duct [see *fig. 1*], taking the anterior border of the masseter muscle for my guide. The incision was about an inch in length, in a vertical direction, and avoiding the external maxillary artery. The ligature was tightly applied, so as to completely close the sinus, of which fact I assured myself by blowing into the cyst by means of a small tube, and also by allowing the patient to masticate a few oats before releasing her.

Twenty-four hours after this second operation, the swelling of the parts began to diminish, and the first wound tended to cicatrization: indeed, all appeared to be going on favourably, with the exception of a slight attack of erysipelas, which invaded the whole of that side of the face; this, however, was soon removed by bleeding, proper diet, and nitrated drinks, with fomentations to the part.

There remained, however, still some doubts as to the probable result of this second operation. It must be borne in mind, that the ligature was applied on a membranous sinus endowed with little vitality; the fluid to which it gave passage was also of a nature to render the success precarious on the sloughing of the ligature. The result might have been different, had it been an artery endowed with more vitality, and the fluid, blood, which would have tended to create that degree of inflammation so necessary to the union of the parts after a ligature falls off. These doubts, which I had taken care to communicate to the proprietor of the animal, were unfortunately converted into realities at the time the ligature came away, which happened six days after the operation, when the saliva escaped as before. I now considered it a hopeless case, and made sure that the mare would have for life an incurable salivary fistula.

Many days, however, had not elapsed, before a considerable tendency to cicatrization was observed in the parts, and every day the external meatus became smaller, and with this the escape of saliva diminished. This spontaneous change for the better gave new

hopes, in which we were not disappointed. Twenty days after the ligature had come away, the external opening was so small that a pin could not have been introduced, and the escape of saliva so little, that it hardly wetted the hair : in this state it continued for a month longer, after which the whole had disappeared ; and from that time to the present, eight months afterwards, no unpleasant symptom has occurred.

REMARKS ON THE CASE.

First : all authors who have reported cases of salivary calculi have always found them in the interior of the salivary ducts, particularly in the stenonian : none of them have mentioned any being found at any distance from the salivary ducts, and contained in a sac, *sui generis*, having a direct communication with the duct. The veterinary authors who have written on the subject are, Sig. Vieillard, Legeune, Brassard, Mazure, Sise, Mcilhan, Bettin-ger, Delafond, Christin, and others. In human surgery we have Sig. Richerand, Sabatier, Dupuytren, Monteggia, Cooper, Tavernier, &c. The first describe those that have occurred in the horse, mule, ass, and ruminants ; the second, those found in man : but all were found in the ducts, so that this extraordinary case seems to stand alone.

Secondly : if we reflect on the mode in which this could have taken place, I cannot agree with those of the profession to whom I have communicated the case, that it first was formed in the stenonian duct, and afterwards found its way through the parietes, and then by its gravity and volume reached its final position. This could not have been the case, as it was first observed there, and much smaller in size. In my opinion the duct might have been opened by accident, such as a nail in the stall, and the saliva infiltrated into the cellular tissue, without escaping through any opening in the skin : the external wound being small would readily heal up, as is often the case, and the cyst would thus become formed by the surrounding parts. The saliva remaining thus stagnated, its calcareous constituents would become deposited, and thus a calculus be formed, which gradually increased in size. The spontaneous cicatrization which took place afterwards in the fistula might have occurred through some mechanical obstruction which closed the orifice at that precise time. It is true that many persons have seen fistulæ close ; but this always occurred at the time when intense inflammation was going on, and by the process of granulation set up in the parts ; but in this case some obstruction seemed to have been the cause of suspending the escape of saliva, thus allowing of the perfecting of the cure.

EXPLANATION OF PLATE I (FRONTISPIECE).

- Fig. 1.* A section of a stomachical calculus (*see page 3*).
- 2. An intestinal calculus of the triple phosphate kind, from the collection of Mr. A. Henderson.
 - 3. A section of a triangular calculus, shewing the tendency in the first instance to the deposition of the phosphates in concentric circles or lamellæ.
 - 4. A calculus impacted in the rectum. The specimen forwarded by Mr. Field (*see page 11*).
 - 5. An oat-hair calculus. The section shews the disposition its constituents have to assume a regular form, but which is prevented by the intervention of vegetable fibre.
 - 6. A portion of the oat-hair calculus magnified, in which the hairs may be seen mixed with crystals of the phosphates.
 - 7. An oat of the natural size, shewing the hairs on it.
 - 8. Magnified hairs of the oat.
 - 9. The same, much more magnified, shewing their bulbous insertions and curved form.

EXPLANATION OF PLATE II.

Fig. 1, 2, 3. Phlebolites from the jugular vein of a horse, of their natural size, and in the relative position in which they existed (*see page 66*).

— 2. One of the phlebolites laid open, shewing its internal structure.

— 4. The jugular vein reduced to one-third its natural size. Below the dotted line it had become impervious.

— 5. The concave surface of the liver of the same animal, shewing the strange structural alteration this organ had undergone, and the effusion of blood underneath its peritoneal tunic.





EXPLANATION OF PLATE III.

Fig. 1. A calculus of the natural size in a dog's bladder, firmly grasped by the coats of that viscus (*see page 64*).

— 2. A section of the calculus.

— 3. A group of fragments of a calculus, passed with the urine of a horse: the natural size (*see page 49*).

— 4. Represents a broken pebble impacted in the ilium of a dog: reduced in size to one-half. It occurred in the practice of Mr. Simonds.

INDEX.

A.

- Accumulations in the intestines, 16
- Acids are eliminated by the kidneys, 23
- Acid, benzoic, composition of, 18
 - carbonic, origin of, 19
 - lactic, a solvent for the phosphates, 6
 - hydrochloric, action of as a lithontriptic, 28, 30, 31, 36, 49
 - hippuric, composition of, 18
 - its change into benzoic acid in the urine, 19
 - oxalic, how formed in urine, 19
- Ainslie, Mr., his cases of cystic calculi in the dog, 64
- Ammonio-magnesian phosphates, the chief constituents of stomachical calculi, 5
 - also found in intestinal calculi, 8
- Ammonia, carbonate of, how formed in the urine, 18
- Andral, M., on the formation of phlebolites, 71
 - on the varieties of biliary calculi, 78
- Analysis of stomachical calculi, 5
 - intestinal calculi, 10
 - the oat-hair calculus, 13
 - renal calculi, 22, 53
 - cystic calculi, 35, 51, 58, 65
 - sabulous matter, 24
 - urethral calculi, 40, 50
 - of phlebolites, 71, 75, 76
 - calculi from the clitoris of an ass, 76
 - from the thoracic duct of a horse, 76
 - biliary calculi, 78

B.

- Baldwin, Mr. G., records case of sabulous matter in the bladder, 24
- Barth, Mr. W. W., removes some calculi from the clitoris of an ass, 76
- Benzoate of ammonia and carbonic acid, how formed in the urine, 19
- Bezoar stones, description of, 1
 - fictitious, composition of, 2
 - their formation, an interesting inquiry for the physiologist, 2
- Biliary calculi, cases of in the horse, ox, and sheep, 77
 - on the formation and kinds of, 78
- Bladder filled with sabulous matter, instance of, 23
 - coats of, much disorganized, 40
 - bursten, cases of, 59
- Blaine, Mr. D., on calculi in the dog, 17, 63

- Bowles, Mr. J., his cases of renal calculi, 21
 Brain, ossification of (in note), 80
 Brodie, Sir B., on injection of acids into the bladder, 57
 Bulimia, the cause of extraneous substances met with in the alimentary canal,
 3, 7, 8

C.

- Carbonate of lime, the principal constituent of urinary calculi, 19
 — how formed in the urine, 18
 Calculi, divisions of, 3
 — found less frequently in the lower animals than man, 19
 — stomachical in the horse, cases of, 3
 — composition and formation of, 5
 — indications of obscure, 6
 — in ruminants, 7
 — intestinal, in the horse, 8
 — divisions of, 8
 — triple phosphatic, formation of, 8
 — indications of, 9
 — composition, &c. of, 10
 — in the rectum, cases of, 11
 — oat-hair, formation of, 12
 — composition of, 13
 — mixed, constitution of, 14
 — case of, 14
 — intestinal, in cattle, 16
 — sheep, 17
 — the dog, 17
 — urinary, constitution of, 19
 — renal, cases of, 20, 21, 22, 53, 63
 — causes of, 20
 — symptoms and treatment of, 22, 47
 — uretal, 20
 — cystic, kinds of, 23, 25
 — cases of, 26, 28, 30, 40, 49, 57, 61, 65
 — modes of removal of, 41, 43, 48, 52
 — solvents of, 48, 52
 — in ruminants, 7, 53, 57
 — in sheep, uncommon, the reason an interesting inquiry, 60
 — cystic, 60
 — composition of, 17
 — in the dog, 17, 63
 — from the thoracic duct of a horse, 76
 — clitoris of an ass, 76
 — biliary, in the horse, case of, 77
 — ox, 77
 — sheep, 77
 — salivary, 79
 Calculus, derivation of the term, 1
 — mulberry, composition of, 18
 — urethral, cases of, 36, 37, 58
 — cystic analysis of, 35, 51, 58, 65
 — salivary, case of, 79
 Carswell, Dr., on the formation of phlebolites, 71
 Carter, Mr. J., records case of calculi in the bladder and urethra of a bullock, 58
 Cartwright, Mr. W., his case of stones found in the second stomach of the cow, 8

Cattle, calculi in intestines of, 16

———— bladder of, 57

———— urethra of, 58

———— kidney of, 53

Chemical and vital laws act in unison in the animal economy, 2

Clift, Mr., suggests to Dr. Wollaston the constitution of the oat-hair calculus, 13

Crabbe, Mr. W., records cases of cystic calculi in sheep, 60

Cross, Mr., on cystic calculi in sheep, 62

Cystectomy described, 41

———— case of, 44

D.

Dick, Professor, on the oat-hair calculus, 13

Dilator urethra, proposed form and description of, 42

Dog, calculous concretions in, 17

———— calculus, renal, cases of, 63

———— analyses of, 64, 65

———— cystic, cases of, 64

Draper, Mr. G., his case of calculus removed by hydrochloric acid, 49

E.

Elliotson, Dr., on the existence of phlebolites, 74

Ernes, Mr. W., translates Professor Mazza's case of salivary calculus, 79

Evison, Mr., his case of sabulous matter in the bladder, 24

F.

False membranes, formation of, in the bladder, 40, 46

Field, Mr. W., his case of calculus in the rectum, 11

G.

Galvanism proposed as means of removing calculi, 52

Gravel, supposed case of, 49

Griffiths, Dr., in a case of poisoning detects sulphuric acid in the kidneys, 23

Guano, cause of its value as manure, 19

H.

Hæmaturia, cases of, 47

Hair-balls, how formed, 7

Hodgson, Mr., on the formation of phlebolites, 71

Hoskins, Mr., proposes the nitro-saccharate of lead as a solvent for calculi, 52

Hutton, Mr. R. R., his case of calculi removed by the action of hydrochloric acid, 49

I.

Intestinal calculi, kinds of, 8

———— composition and forms of, 9

J.

Jones, Mr. J., his case of calculus in the rectum, 11

L.

Lactic acid suggested as a solvent for stomachical calculi, 6

Landener, his analysis of biliary calculi in sheep, 77

Lautour, M., case of renal calculus in a dog, 63

Lime, carbonate of, how formed in urine, 19

——— the chief constituent of urinary calculi, 19

——— phosphate of, found in urine, 18

Lithectasy, described, 41

——— case of, 44

Lithia, carbonate of, a solvent for calculi, containing uric acid, 52

Lithotomy, case of, 26

——— operation described, 41

Lithrotomy, case of, 30

——— accidental case of, 28

——— operation described, 41

M.

Maclogan, Dr., his analysis of an oat-hair calculus, 13

Mazza, Professor, his case of salivary calculus, 79

Mekel, M., on the formation of phlebolites, 71

Millers' horses said to be frequently the subjects of stomachical calculi, 3

Mixed calculi, composition of, 14

——— case of, 14

Mogford, Mr. W., on removal of calculi from the bladder, 43

N.

Nitro-saccharate of lead, a solvent for phosphatic calculi, 52

O.

Oat-hair calculi, how formed, 12

——— composition of, 13

Ossification of the brain of an ox, instance of, 80

P.

Pancreatic juice, composition of, 9

Percivall, Mr. W., on salivary calculi, 79

Phlebolites, case of, in the jugular vein, 66

——— their formation, 69, 70

——— analyses of, 75, 76

Plates, explanation of, 84 et seq.

Polypus in the bladder, 41

Prout, Dr., on solvents for calculi, 51

Purves, Mr. J., his case of calculus in the bladder retained by false membranes, 40

———— of biliary calculi in the biliary ducts and intestines, 76

R.

Robinson, Mr., extracts the largest calculus on record, 26

Rush, Mr. W., his cases of urethral calculi in oxen, 58

S.

Sabulous matter in the bladder, cases of, 23, 24

———— its composition, 24

———— source of, 25

Salivary calculus, case of, 79

Sewell, Professor, his cases of cystic calculi, 26, 28

Sheep, calculous concretions in the intestines of, 17

———— bladder of, 60

Simonds, Mr. J. B., his case of calculus in the bladder removed by lithectomy, 44

———— on urinary calculi in cattle, 53

———— in sheep, 60

———— records a case of phlebolites in the jugular vein of a horse, 66

———— on the formation of phlebolites, 69

———— presents a calculus taken from the thoracic duct of a horse, 76

Smith, Mr., his case of renal calculus, 21

Solution of calculi how effected, 48, 51

Solvents for calculi, 48, 52

Sowerby, Mr. J. de C., on the structure of the oat-hair, 13

Spooner, Professor, his case of lithotrity, 30

———— his objections to lithotomy, 32

———— his case of urethral calculus, 37

———— on the formation of phlebolites, 72

Stanley, Mr. W., his case of stomachical calculus, 3

———— composition, &c. of, 4

Stomachical calculi, cases of, 3

———— constituents of, 5

———— causes of formation, 5

Sylvester, Mr., on accumulations in the intestines, 16

T.

Thacker, Mr. W., his case of cystic calculus in the dog, 64

Tiedmann on the formation of phlebolites, 71

Tombs, Mr. J., his case of renal calculus in a cow, 54

Triple phosphates, found in stomachical calculi, 5

———— in intestinal calculi, 8

Turner, Mr. T., his case of renal calculus, 22

U.

Urea, composition of, 18

———— transmutations of, 18

- Ure, Dr., proposes carbonate of lithia as a solvent for the urates, 52
 Uretal calculi, 20
 Urethral calculi, instances of, 36, 37
 ——— dilator, form for, 42
 Uric acid, composition of, 18
 ——— not found in the graminivora, 18
 ——— found in the carnivora, 18
 ——— herbivora, 53
 Urinary calculi, cases of, 26, 28, 30, 40, 49, 57, 61, 65
 ——— kinds of, 23, 25
 ——— rarely have nuclei, 25
 Urine of the horse, composition of, 18
 ——— ox, composition of, 18
 ——— bloody, not to be relied on as indicative of calculi, 47

V.

- Vein stones, case of, 66
 ——— analyses of, 75, 76

W.

- Wells, Mr. J., on cystic calculi in sheep, 62
 Wilson, Mr. Erasmus, on the formation and kinds of biliary calculi, 78
 Wollaston, Dr., on oat-hair calculi from the human subject, 13

Y

- Youatt, Mr., on concretions in the stomachs of cattle, 7
 ——— on intestinal calculi in cattle, 16
 ——— on urinary calculi in cattle, 53
 ——— on cystic calculi in cattle, 57
 ——— on urethral calculi in cattle, 58.

BY THE SAME AUTHOR.

Lately published, Third Edition, Price 10s.

A MANUAL OF VETERINARY PHARMACY,
containing the Chemical and Therapeutical History of the Substances used in Veterinary Medicine; with an Attempt at their Classification, and the Pharmacopœia of the Royal Veterinary College.

"This work not only reflects much credit on the Author, but has conferred a great obligation on every veterinary surgeon, and every veterinary student. Moreover, it will raise the reputation of veterinary science"—*Professor Coleman*.

"It is a valuable work, and should be in the possession of every veterinary student."—*Professor Sewell*.

"We have made few literary announcements with greater pleasure than we do this; for there was nothing more connected with the wishes and the wants, and, we are perfectly assured, the improvement of the veterinary pupil."—*Veterinarian*.

"It is with great pleasure that we announce a second edition of this most useful work. It is increased in size more than a third, and, what we had scarcely thought to have been possible, is in more than that proportion valuable to the student of veterinary medicine."—*Ibid*.

"Although Mr. Morton speaks modestly of his labours, we can assure our readers that they will find in them a Manual not only fully adequate to the application it has assumed, but also one which is commensurate with the present standard of science in this department."—*Lancet*.

"This is a useful work for the veterinary surgeon, and does credit to the talents and industry of Mr. Morton."—*Medical Gazette*.

"This is a valuable book to the veterinary student, and will materially assist in raising the veterinary art to its just level with other professions. The author is evidently a man of talent and discrimination."—*Medical Times*.

"We have seldom looked in a book which has better pleased us than the above. It contains the history, composition, dose, and effect of every drug employed in the treatment of the horse or cattle. These are arranged in an admirable manner, so that, as a work of reference, there is no difficulty in at once turning to the precise page which contains the desired matter. The style of the book is easy, and, while the science it displays commands our respect for the author, its condensation, clearness, and intelligibility, more than all, deserve our thanks."—*Christian's Monthly Magazine*.

ALSO,

A VETERINARY TOXICOLOGICAL CHART,
containing those AGENTS which are known to cause DEATH in the HORSE; with the SYMPTOMS, ANTIDOTES, ACTION ON THE TISSUES, and TESTS.

Price 3s. 6d.;—mounted in a case, 6s.;—mounted on a roller and varnished, 8s. 6d.

"This gift is scarcely inferior to those with which he has already presented his veterinary brethren. No great time will pass ere it will be suspended in the pharmacy of every practitioner."—*Veterinarian*.

"A very complete and useful sheet..... The tests are illustrated by coloured diagrams, and this chart is altogether the best we have seen. It should find a place in all veterinary surgeries."—*Medical Times*.

"The Author of these works is the first veterinary adventurer into the fields of their respective subjects, and admirably has he fulfilled his difficult task..... Both these works ought to be in the hands of every veterinary surgeon and student, as well as of every medical man who knows the importance of keeping pace with the rapidly extending knowledge of a science so nearly related to his own."—*Statesman*.

"The above chart is a valuable contribution to veterinary medicine, and its design and execution reflect great credit on its author. We recommend it with much confidence to our medical friends..... and we have no doubt that, in the surgery of the veterinarian, the Toxicological Chart will occupy a conspicuous place by the side of another work by the same author, the 'Manual of Veterinary Pharmacy.'"—*Lancet*.

COMPTON AND RITCHIE, PRINTERS. MIDDLE STREET, CLOTH FAIR, LONDON.

